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ABSTRACTS

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The Vegetation of Yezo.

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(Communication from the Botanical Institute, Hokkaido Imperial University, Sapporo. Received October 23, 1924).

1. Foreword.

For the past thirteen years Dr. MIYABE and I have together devoted ourselves to the study of the Flora of Hokkaido, working on a collection of materials of which he laid the first foundations some thirty years before the beginning of our collaboration. The enumeration of all the species growing in Hokkaido, which has been the first objective of our labours, is nearing completion. In the meantime the notes I have made during these years spent in studying Yezo plants, with occasional periods devoted specially to their ecology, enable me to compile this general review of the vegetation of Yezo, a work, which, so far as I am aware, is the first of its kind to be published.

2. A sketch of the topography and climate of Yezo.

The island of Yezo is situated to the north of Honshu (the Main Island of Japan), between 41° 24′ and 45° 31′ North latitude and between 139° 45′ 30″ and 145° 49′ East longitude. It is almost rhombic in shape, with a coast-line of about 1808 miles and an area of about 30,535.5 square miles. From a topographical and geological standpoint, the island of Yezo may be considered as divided into two parts—the East and the West—by the Median Depression, which extends from Ishikari to Tomakomai.

In the western division, which has an area of less than one-sixth of the whole island, there are no large rivers and no broad plains. Almost the whole surface is mountainous, though high peaks are not numerous, the only one above 5,000 feet being the extinct volcano Mt. Yotei (nearly 7,000 feet high), otherwise known as the Yezo-Fuji from its similarity in shape to the famous peak in the south of Honshu. Other prominent peaks, varying in height from 3,000 to 5,000 feet, are Iwaonupuri, Usu, Tarumai, Yeniwa, Yurappu, Komagatake, *etc.*, all volcanoes and some still more or less active.

In the eastern division, on the other hand, there are two great rivers flowing through broad plains, namely the Ishikari, which is the longest river of Yezo, discharging into the Japan Sea, and the Tokachi flowing into the Pacific, besides a few others of considerable importance. The mountains are grouped in three prominent ranges meeting about the centre of the island, where there are a number of peaks exceeding 6,000 feet, the highest point of Yezo being Mount Taisetsu (also called Asahi-dake or, in the Ainu language Nutakkamushpet), 7,500 feet, with Mount Ishikari second. Of the ranges radiating from this centre, one, known as the Hidaka Range, runs south to Cape Erimo with the Yubari heights as an outlier on the west side, and is entirely of palaeozoic formation, the second, running eastwards to the extremity of Shiretoko peninsula in Nemuro Province and known as the Kurile Range, consists of a chain of extinct volcanoes, notably O-Akan and Me-Akan, Atosanobori and Raushi, and the third, mainly of palaeozoic formation, runs in a north-easterly direction to Soya Cape which is the northern extremity of Yezo.

The numerous rivers have very winding channels in the alluvial plains, often forming pools or swamps by changing their course. On either side of some of these rivers the land rises in terraces. This terraced formation is seen at its best, sometimes with three or four tiers, in certain localities along the sea-coast. The smaller rivers on approaching the sea mostly take a sharp bend and run for some distance parallel to the shore, separated only by a sand-bank.

The sea-coast generally is comparatively unindented, and sandy beaches are extensively developed, frequently backed by sand-dunes. But in a few places, such as the Shakotan peninsula of Shiribeshi Province, the mountains rise abruptly from the water, and in others rocky formations jut out boldly into the sea.

Lakes are numerous. Saruma, Abashiri, Notoro, Furen, and Yudo are salt, and Shikotsu, Toya, Kutcharo, Akan, Mashu, Onuma (with Konuma) and Junsainuma are fresh-water lakes.

Currents. The Pacific coast of Yezo is washed by the cold current Oyashiwo, which comes from the Arctic through the Behring Sea and flows along the east coast of Kamtschatka, then takes up a weaker current coming down the west coast of Kamtschatka, continues along the Pacific side of the whole Kurile chain and of Yezo, and reaches as far south as the cape called Inu-bo-ga-saki in Honshu, where it meets the warm current Kuroshiwo coming from the opposite direction. The warm current known as the Tsushima Stream, a small branch of the

Kuroshiwo, comes north along the Sea-of-Japan coast of Honshu and produces a weak offshoot which passes through Tsugaru Strait and, entering Volcano Bay, strikes the Iburi coast, but the main volume washes the west coast of Yezo, passes through La Pérouse Strait, then along the Kitami Province littoral, and northwards again along the Okhotsk side of the Kurile Archipelago, reaching as far as the island of Paramushir.

Climates. The data here presented are compiled from the records of the meteorological stations in Yezo. The following tables show the position of each station and the number of years during which observations have been taken at each, as well as the meteorological statistics.

List of Stations.

Station.	N. Lat.	E. Long.	Height above sea level	Length of records in years
Hakodate	41.46	140.44	3.7 m	28
Suttsu	42.48	140.13	16.7 m	28
Sapporo	43.45	141.20	16.9 m	28
Kamikawa	43.47	142.22	113.3 m	28
Erimo	41.55	143.15	63.6 m	28
Tokachi	42.55	143.12	39.5 m	25
Kushiro	42.59	144.24	34.2 m	7
Nemuro	43.20	145.35	26.7 m	28
Abashiri	44.01	144.17	38.6 m	27
Shana	45.14	147.53	39.3 m	14

Air Temperature.

Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Hakodate	-3.0	-2.3	0.6	6.4	10.5	14.4	18.4	21.1	17.4	11.5	5.3	-0.5	8.3
Suttsu	-3.3	-2.6	0.0	5.7	10.2	14.1	18.0	20.7	17.4	11.5	4.8	-1.2	7.9
Sapporo	-6.5	-5.5	-1.8	5.2	10.4	14.7	18.5	20.3	16.1	9.3	2.8	-3.4	6.7
Kamikawa	-10.1	-8.9	-4.4	3.6	10.0	15.2	18.8	19.9	14.3	7.2	0.7	-6.2	5.0
Erimo	-2.8	-2.7	-0.7	3.5	7.0	10.8	15.1	18.2	16.6	12.0	6.1	0.3	6.9
Tokachi	-11.1	-9.8	-4.2	4.1	9.6	13.9	17.4	19.1	14.3	7.8	0.9	-6.5	4.6
Kushiro	-6.6	-6.2	-2.3	2.7	6.6	11.0	15.0	17.4	14.5	9.3	3.3	-3.9	5.1
Nemuro	-5.2	-5.6	-2.6	2.9	6.5	9.9	13 8	16.7	15.0	10.3	4.2	-1.7	5.3
Abashiri	-7.1	-7.2	-3.4	3.6	8.4	12.1	16.3	18.9	15.4	9.5	2.6	-3.4	5.5
Shana	-5.3	-7.3	-4.4	1.2	5.4	9.0	12.9	15.0	12.7	8.4	2.6	-2.7	3.9

Amount of Precipitation.

Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept	Oct.	Nov.	Dec.	Total
Hakodate	61.3	62.9	67.6	64.8	82.9	92.6	141.1	135.0	155.7	117.8	92.6	88.3	1155.6
Suttsu	91.2	85.2	75.5	59.8	66.4	59.5	92.5	105.0	138.3	136.2	133.5	114.0	1157.1
Sapporo	71.7	65.0	62.5	56.1	63.3	59.4	108.8	98.6	129.0	107.2	99.4	94.5	1015.5
Kamikawa	65.0	44.2	56.2	51.1	63.7	79.0	117.0	128.4	136.5	110.2	106.4	98.5	1056.2
Erimo	27.1	24.8	42.3	74.0	93.9	94.3	110.2	102.1	118.7	106.2	75.4	56.7	925.4
Tokachi	38.7	40.9	60.5	64.6	95.5	98.0	104.6	127.1	134.2	97.2	45.7	49.1	955.9
Kushiro	43.1	39.3	74.5	88.6	91.4	112.0	142.5	148.5	158.3	107.3	53.0	50.8	1109.3
Nemuro	33.0	26.5	55.8	72.2	90.6	91.2	95.1	106.8	135.5	93.9	74.6	59.6	934.8
Abashiri	46.8	32.7	61.8	48.3	59.9	61.1	88.1	94.7	106.0	69.4	57.3	51.9	783.0
Shana	96.2	56.0	72.2	60.0	81.1	62.6	84.5	66.3	87.3	96.3	119.4	103.2	985.1

The cold and warm currents exercise a great influence over the climate, so that the summer temperature is comparatively low on the Pacific littoral and higher along the Sea-of-Japan and Okhotsk coasts. The range of temperature in the interior is continental, from a winter minimum of -41.0 to a summer maximum of 34.8. The island of Yezo lies between the isotherms (of average mean temperature for the whole year) of 8.3 and 3.9 Centigrade, the direction of fall in temperature being from south-west to north-east. From January to April the thermometer keeps comparatively low, it rises suddenly in May, attains its maximum in August, and falls suddenly in November. The precipitation is copious, and is distributed throughout the year, the maximum coinciding with the period of vegetative activity, namely May to October. The snow-fall is usually heavy, continuing from November to April.

3. The Forests of Yezo.

The forests of Yezo are to a great extent still intact, and cover some 13,477,570 acres or more than half the area of the whole island. They are usually composed of a mixture of deciduous broad-leaf trees and ever-green coniferous species, and extensive associations formed of the one type to the exclusion of the other are very rare, though the proportion in which they are combined varies greatly according to locality. Generally speaking, the forests of the south-western half are mostly of the "Summer-Forest" type, that is to say the deciduous broad-leaf species are predominant, while those of the north-eastern half are more

commonly of the Coniferous-Forest type or, in other words, contain a preponderance of Coniferous trees.

The deciduous broad-leaf trees of the Yezo woods and forests belong to familiar genera of Northern Honshu, and include several species each of Willow, Alder, Birch, Oak, Cherry, Maple, and one or two species of Hornbeam, Beech, Poplar, Walnut, Chestnut, *Cercidiphyllum*, *Phellodendron*, Linden, Cornel, Ash, *Pterocarya*, *etc.* The largest of these Yezo trees is *Populus Maximowiczii*, which often attains a height of 100 feet with a trunk up to 6 feet in diameter. *Cercidiphyllum japonicum* ranks next, and *Quercus grosseserrata* ranks third. The most widely distributed trees are *Ulmus japonica*, *Ulmus laciniata*, *Betula japonica*, *Betula Ermani*, *Morus bombycis*, *Alnus hirsuta*, *Prunus serrulata* var. *sachalinensis*, *Tilia japonica*, *Acer pictum*, *Tilia Maximowicziana*, *Kalopanax ricinifolium* and *Fraxinus pubinervis*.

Salix is the genus richest in species, and some, like *Salix jessoensis* and *Salix cardiophylla* var. *Urbaniana*, are large and handsome trees. They usually form almost exclusive associations on the banks of rivers.

The Birches, except *Betula Ermani*, are handsome and grow to a good size. *Betula Ermani*, ecologically a very interesting species, is the common Birch in the mountain regions of Yezo, having here a greater altitudinal range than any other representative of the genus. Owing to the wide area of its distribution and the consequent diversity of climatic conditions to which it is exposed, it exhibits many variations; in lowlands, growing among other deciduous trees, it develops tall and slender trunks with short and slender branches. In open stands, the trunk is usually divided near the base into several massive stems, and these branch to form a wide-spreading crown. In the alpine zone of the higher mountains it is reduced to a low and very spreading shrub with prostrate branches and small leaves, and often forms a pure association, an example of which I have seen on the upper slope of Mount Rishiri where this shrubby growth covers a wide expanse and shows up to great effect with its pale green foliage. The magnificent *Betula Maximowicziana* is common in southern and central Yezo, where it grows from 70 to 100 feet tall, with a trunk devoid of branches for more half its height, shaggy bark of an orange-gray colour and a crown of mop-like or roundish shape. *Betula japonica* occurs in fair abundance on the lowlands, and in some places in pure stands; it is a tree of moderate size, with slender branches and a very white bark.

Of the Alders, *Alnus japonica* var. *arguta* reaches its maximum development in open swampy country, where it forms by itself extensive

woods: it has a slender symmetrical crown and a rough grey bark. *Alnus hirsuta* is a very bushy tree with a short trunk, stout in proportion and often gnarled, clothed with a nearly smooth pale grey bark; it is very abundant in open grassy country, where woods formed almost exclusively of this species are to be found. Another Alder which is common on the upper parts of all high mountains is *Alnus Maximowiczii*. It is always a much branched shrub and often forms a pure association. Although poorer in species than in other parts of Japan Proper, the Quercus genus furnishes one of the principal elements of the deciduous forests of Yezo, important not only in respect of number and size of the trees, but also on account of their commercial value. They are all deciduous. *Quercus grosseserrata*, distributed as far north as the Southern Kuriles, is one of the largest and noblest denizens of the forest, growing to a height of a hundred feet or more, with stems three to four feet in diameter, and is also a timber-tree of the first class. *Quercus dentata* is a handsome tree attaining in open woods a stature of 80 feet or more, with a trunk more than three feet in diameter; in certain maritime regions, however, it is found in pure associations as a shrub or low tree with crooked gnarled stems, as for instance along the coast near Zenibako in the province of Shiribeshi and on the Pacific littoral of Hidaka Province. The bark of this tree is highly valued for tanning leather. *Quercus glandulifera* ranges in Yezo nearly as far north as the vicinity of Sapporo, although it is not really abundant north of Volcano Bay. *Quercus mongolica*, on the contrary, grows in the north-eastern half of Yezo, being especially common along the northern coast of Kitami Province, thus forming an instance of the floristic connection between this district and Saghalien, where it also occurs.

The Cherries, except the shrubby *Prunus kurilensis*, are handsome and grow into trees. The most conspicuous is *Prunus serrulata* var. *sachalinensis*, which is more abundant in Yezo than in any other region. It becomes a splendid tree from 60 to 75 feet tall with a clean trunk from 2.5 to 3.5 feet in diameter, and relatively short ascending or ascending-spreading branches which form a shapely head. *Prunus Maximowiczii* is common in thickets and forests, and is remarkable for its white racemose inflorescence, foliaceous bracts and pubescent obconical calyx. Among the Cherries belonging to the subgenus *Padus*, *Prunus Ssiori* is widely distributed in Yezo as far north as the Southern Kuriles, and is a conspicuous and beautiful feature of the landscape in early autumn, as the leaves turn deep scarlet and give colour to the forest before the Maples assume their brightest hues. *Prunus Grayana*

grows in the southern and central parts of Yezo, while *Prunus Padus* is distributed in the central and northern parts.

The forests of western and central Yezo owe much of their beauty, variety and interest to the Maples. *Acer pictum* is the commonest, and the only one attaining considerable size. In open country and in swamps, *Acer Ginnala* and *Acer Miyabei* are scattered; the latter is a semi-endemic species; the former assumes the loveliest autumn tints. *Acer cissifolium* is an interesting species having trifoliate leaves, and male and female flowers on separate trees. It grows in southern and central Yezo, and is a handsome compact round-headed tree with graceful leaves of a delicate green in summer and red in late autumn. In the same parts of Yezo, *Acer japonicum* and *Acer palmatum* are both common, and the wonderful scarlet and crimson of their foliage contribute greatly to the autumnal beauty of the forests. *Acer Mayri*, very common in the vicinity of Sapporo, is a handsome tree, especially ornamental in the month of May, when the yellow flowers and reddish young leaves open simultaneously.

Of the Elm family, Yezo possesses two important species. One is *Ulmus japonica* growing on river-banks, plains and low hills, abundantly distributed and not infrequently a prominent feature of the landscape with its broad heads of graceful pendant branches. The second Elm is *Ulmus laciniata*, a rather small tree with a tough inner bark which is used by the Ainu aborigines to weave coarse tissue for their clothes.

In Yezo forests *Magnolia obovata* is one of the most beautiful trees, and in early autumn its brilliant scarlet cones of fruit standing out on the branches are particularly striking. It is widely distributed in Yezo as far north as the Southern Kuriles. *Magnolia Kobus* var. *borealis* is a tree of considerable size frequently found in the depths of the forest or by the sides of streams, and is very showy in early spring with its wealth of white blossoms which appear before the leaves.

The forests of western and central Yezo are distinguished by the presence of *Cercidiphyllum japonicum*, which grows in deep rich soil on plains or on the slopes of hills and attains to great size, often rising to the height of a hundred feet. It may form a single trunk 3 to 5 feet in diameter and free of branches for fifty feet above the ground or it may send up a number of stems which are united for several feet into a stout trunk and then gradually diverge.

The Japanese Cottonwood (*Populus Maximowiczii*), distributed widely along the Pacific coast of Eastern Asia, occurs in rich alluvial soil along the banks of rivers or in the vicinity of streams, associated

with many broad-leaf trees. The Yezo-Aspen (*Populus tremula* var. *jessoensis*) grows generally in volcanic regions forming pure associations covering wide tracts of country.

Two species of Hornbeam (*Carpinus cordata* and *Carpinus laxiflora*) occur in Yezo, growing in rich moist soils along river-banks, in valleys or on mountain slopes; the latter is confined to the Pacific coast. In rich soils *Ostrya japonica* may be found growing with them.

Two species of Linden are found, and both are abundant. The larger of the two, *Tilia Maximowicziana*, is a handsome tree growing to a hundred feet in height. The other Linden is *Tilia japonica*, which hardly exceeds sixty feet.

Simarubaceae, mainly a tropical family, is represented in Yezo by a single species—*Picrasma quassioides*, a member of a small tropical Asiatic genus, a slender tree 20–30 feet in height.

Aesculus turbinata is limited in Yezo to the southern half, finding its most northern home near the coast of Zenibako in Shiribeshi Province.

Juglandaceae is represented in Yezo by two genera, each with a single species: *Juglans Sieboldiana* is distributed throughout the Island, while *Pterocarya rhoifolia* is confined to the south.

Kalopanax ricinifolium is exceedingly common in the forests of Yezo; it has a tall trunk 4–5 feet in diameter and immense limbs standing out from the trunk at right angles like those of an old pasture Oak.

Styrax Obassia is valuable as an ornamental tree, having a straight slender stem, long graceful branches and beautiful white bell-shaped flowers. *Styrax japonica*, a rather small tree which is common in the mountain forests of Honshu, grows only in southern parts of Yezo.

Of the Olive family, there are only three species in Yezo which can properly be called trees. *Fraxinus mandschurica*, common in Manchuria, Korea and Saghalien, is a noble tree in our region, frequenting low ground near the borders of swamps and streams, growing often to the height of a hundred feet with trunk 3–4 feet in diameter, and stout orange-coloured branchlets with light green foliage. The remaining two species—*Fraxinus pubinervis* and *Syringa japonica*—are common on plains and hill-slopes.

Besides the broad-leaf deciduous trees above mentioned, Conifers abound in this Island, and in many parts predominate. Even at low altitudes Conifers are common, and in some place, notably in the northern and eastern districts, they almost entirely supersede the broad-leaf trees. One Pine originating in Northern Honshu (*Pinus pentaphylla*), occurs mainly on the slopes of mountains of palaeozoic formation,

namely in two localities in Oshima Province, on the island of Okushiri and in the south-east corner of Hidaka Province, growing in conjunction with Firs and Spruces or with broad-leaf trees such as *Cercidiphyllum japonicum*, *Ulmus japonica*, *Quercus grosseserrata*, *Carpinus laxiflora*. The Creeping Pine (*Pinus pumila*) of North-eastern Asia covers the upper slopes and summits of most of the high mountains and is usually associated with *Phyllodoce coerulea*, *Sorbus sambucifolia*, *Rhododendron chrysanthum*, Willows and alpine plants; it descends to sea-level in the Northern Kuriles and Saghalien, growing on sand-dunes and in meadows with *Empetrum nigrum*, *Cornus suecica*, *Lonicera Chamissoi etc.*

Two Firs (*Abies sachalinensis* and *Abies Mayriana*) are both plentiful, the first-named being common in northern and north-eastern parts, either forming pure forests or associated with *Picea jezoensis* and *Picea Glehni*, while the second is common in the south either alone or associated with *Picea jezoensis* and broad-leaf trees.

A flat-leaf Spruce (*Picea jezoensis*) and another with four-angled leaves (*Picea Glehni*) grow in Yezo. The Yezo Spruce is a magnificent tree, often glaucous in appearance, spice-like in habit, usually associated with broad-leaf deciduous trees or with *Abies sachalinensis* and *Picea Glehni* in rich moist forests. Glehn's Spruce has its home in Yezo, although it was first discovered in Saghalien, where it is confined to a small area in the extreme south on the coast of Aniwa Bay, and is by no means abundant; in Yezo, on the other hand, it is exceedingly common in the north and north-east, and it is also distributed to a greater or less extent in the south with the exception of Oshima Province. In the north it is often found in association with *Abies sachalinensis* and *Picea jezoensis* and also as the sole constituent of the forest, but it reaches its maximum development in open swampy country, where it forms exclusive associations covering extensive areas.

One Creeping Juniper (*Juniperus conferta*) is very common on sandy beaches; another (*Juniperus rebunensis*) grows only on high mountains of Central Yezo and also on the islands of Rebun, Rishiri and Etorofu; a third (*Juniperus Sargentii*) is found in rocky places high up the mountains and also on the Pacific coast.

Larix dahurica var. *kamtschatica* is the only native species of the genus *Larix* known in our floral region; it is not recorded in the wild state on the Yezo mainland, being confined to the two islands Shikotan and Etorofu of the Southern Kuriles, where it abounds in swampy places.

To complete the list of cone-bearing trees indigenous in Yezo it

remains to mention a northern variety "*Hondai*" of *Thujopsis dolabrata*, which is confined to Japan and, in Yezo, occurs only in the province Oshima, either forming a pure forest or else in conjunction with many broad-leaf trees.

Of Taxaceae only *Cephalotaxus drupacea* var. *nana* and *Taxus cuspidata* grow in Yezo. The *Cephalotaxus* is scattered here and there from Teshio Province southward, and forms a common undergrowth of forests of *Abies Mayriana* and broad-leaf trees in the Central and Southern Provinces; here, as elsewhere in the colder regions of Japan, it is a shrub 3 to 7½ feet tall. The Yew is much more widely spread, growing as far north as the island of Ketoi in the Kuriles. It is a common tree in the moist forest, growing among Firs and Spruces and broad-leaf trees; at high altitudes it becomes a spreading shrub prostrate on the ground.

There are 24 woody climbers native in Yezo, as shown below, belonging to 11 families. In the following list of species asterisks are used to indicate the relative extent of distribution, four indicating that a plant is distributed as far north as the Southern Kuriles, three that it is distributed throughout the mainland of Yezo, two that it is spread over the western half of Yezo, and one that it is limited to the province of Oshima.

** *Smilax China* L.
* *Clematis stans* S. et Z.
**** *Clematis alpina* Mill.
var. *ochotensis* Makino.
** *Clematis paniculata* Thunb.
* *Akebia lobata* Dcne.
** *Menispermum dahuricum* DC.
* *Cocculus Thunbergii* DC.
**** *Schizandra chinensis* Baill.
* *Schizandra nigra* Maxim.
**** *Hydrangea petiolaris* S. et Z.
*** *Schizophragma hydrangeoides* S. et Z.
** *Pueraria Thunbergiana* Benth.
**** *Rhus ambigua* Lavall.
**** *Celastrus articulatus* Thunb.
** *Evonymus japonica* Thunb.
var. *radicans* Miq.
* *Vitis Thunbergii* S. et Z.
**** *Vitis Coignetiae* Pulliat.
* *Vitis flexuosa* Thunb.
*** *Ampelopsis heterophylla* S. et Z.
** *Parthenocissus tricuspidata* Planch.
**** *Actinidia arguta* Planch.
** *Actinidia polygama* Planch.
**** *Actinidia Kolomikta* Max.m.
* *Hedera japonica* Tobber.

A perusal of the above list shows at once that the number of species of climbing plants decreases gradually from south to north. Yezo has no *Wistaria* nor anything approaching it in beauty, but two *Actinidias* (*Actinidia Kolomikta* and *Actinidia polygama*) climbing the tops of the tallest trees are striking objects in the forests with their pale green and white mottled leaves concealing clusters of fragrant white blossoms in early summer. The trunks of trees are also often adorned to the height of 60 or 70 feet with the showy flowers of the climbing *Hydrangeas* and *Schizophragma*, and in autumn the scarlet colouring of the climbing

Sumach is one of the chief beauties of the country-side. *Evonymus japonica* var. *radicans* and *Hedera japonica* are the only evergreen species of climber, and are confined to the south.

The epiphytic species of the forests of Yezo include no flowering plants, being limited to Ferns of the genera *Polypodium* and *Cyclophorus*, but Mistletoe, represented by two Eastern Asiatic varieties, is common in the broad-leaf forests, growing mostly on *Alnus japonica* var. *arguta*.

The forest-floor is covered, even high up the mountains, with a continuous and almost impenetrable undergrowth of species of *Sasa*, which make travelling off the trails practically impossible except up the beds of streams. These *Sasas*, which vary in height from three to eight feet according to local conditions, make the forest-floor monotonous and often prevent the growth of other under-shrubs except along the banks of streams where they obtain sufficient light to enable them to hold their own.

The proportion of trees to the whole flora of Yezo is remarkable, being about 1:18.9, the number of indigenous flowering plants and Vascular Cryptogams being 1629 species. Still more remarkable is the large proportion of woody plants to the whole flora: in Yezo there are 170 species of shrubs and lianes, or 256 of woody plants in all, making one woody species in every 6.4 of the whole flora.

The deciduous forests of Yezo are essentially an extension of the Summer forests of Northern Honshu, from which they do not differ specifically to any great extent. The Honshu genera are well represented, and so, on the whole, are the species in spite of the more limited number and of the almost complete absence of evergreen broad-leaf trees. *Magnolias*, *Styrax*, *Picrasma*, *Ostrya* and *Carpinus* are a few examples of Honshu types. *Pterocarya*, common in Northern Honshu, is also indigenous in the south of Yezo. No beech grows on the mainland of Eastern Asia nor in China north of Hupeh Province, yet *Fagus Sieboldi* grows in the forests of Yezo. The Yezo Maples have a close relationship with those of Honshu; the Chestnut is that of Japan Proper; the Birches with one exception are of Japanese type, as are the Lindens, the Alders, the *Celtis* and the *Cercidiphyllum*. If we take shrubby species into consideration, such essentially Japanese species as *Helwingia japonica*, *Aucuba japonica* var. *borealis*, *Daphniphyllum humile*, *Ilex integra* var. *leucoclada*, *Lindera umbellata*, *Stachyurus praecox*, *Elaeagnus multiflora*, *Clethra barbinervis*, *Coriaria japonica*, *Enkianthus campanulatus*, are also indigenous in the forests of Yezo. The deciduous forests of Southern Yezo being thus composed largely of the same ele-

ments as the Summer Forests of Honshu, it is particularly interesting to note the gradual diminution of species and genera as we travel north as far as the Southern Kuriles, where, though the number is greatly reduced, we still find these Honshu elements well represented.

The Coniferous Forests of Yezo may be classified into three types; the first type is the forests of *Thujopsis* and *Pinus pentaphylla* which are an extension of those of Honshu, finding their northern limit in South Yezo; the second is the forests of *Abies Mayriana* and *Picea Glehni*, which are both peculiar to Yezo; the third is the forests of *Picea jezoensis*, *Abies sachalinensis* and *Larix dahurica* var. *kamtschatica*, which are related to northern countries—such as Saghalien and north-eastern parts of Continental Asia.

4. The Seashore Vegetation of Yezo.

Ecologically speaking, it goes almost without saying that the vegetation along the sea-coast is directly influenced by the proximity of the sea. The strength of this influence, and the consequent width of the area affected, vary considerably from place to place. Sometimes there is only a strip a few metres wide between the wave-washed margin and the line where the inland plant-associations begin, with scarcely any vegetation established thereon. In other cases there may be a belt, a hundred metres or more in breadth of level, sloping or undulating ground occupied by various maritime plant-associations. In describing this vegetation it is convenient to divide it into three groups according to the three most typical aspects of the maritime belt, namely the sandy-beach including sand-dunes, the rocky shore and the salt-marsh.

The Vegetation of the Sandy-beach. The typical vegetation of the Sandy-beach consists of a scattered or dense growth of sand-loving annual and perennial herbs, sometimes shrubs, and more rarely a few low trees, which maintain a precarious foothold on the more or less shifting sand. The seeds of these hardy plants, originally introduced by various agencies, may lodge in a tangle of drift-wood or other flotsam, which, acting as a barrier to prevent them being swept away, often aids materially in the establishment of vigorous plant-associations. Such associations may not only attain a remarkable profusion of growth, but are also often surprisingly rich in species.

The following is an enumeration of the most characteristic plants of the sandy beaches of Yezo.

Herbs :

Ischaemum anthephroides Miq.
Zoysia pungens Willd.
Hierochloe borealis Roem. et Schult.
Elymus mollis L.
Carex macrocephala Willd.
Carex pumila Thunb.
Polygonatum humile Fisch.
Thesium chinense Turcz.
Atriplex patula L.
Atriplex littoralis L. var. *angustissima* Moq.
Salsola Soda L.
Stellaria humifusa Rottb.
Ammodenia major Kudo.
Aconitum subcuneatum Nakai.
Isatis tinctoria L. subsp. *japonica* Busch.
Arabis pendula L.
Arabis japonica A. Gray.
Lathyrus maritimus Biegl.
Geranium yezoense Fr. et Sav.
Cnidium japonicum Miq.
Phellopteris littoralis Benth. et Hook.
Calystegia Soldanella R. Br.
Tournefortia sibirica L.
Mertensia maritima G. Don. subsp. *asiatica* Takeda.
Scutellaria Schmidtii Kudo.
Linaria japonica Miq.
Orobanche coerulescens Steph.
Artemisia desertorum Spr.
Artemisia Stelleriana Bess.
Senecio Pseudo-Arnica Less.
Lactuca repens Benth. et Hook.

Shrubs :

Juniperus conferta Parl.
Rosa rugosa Thunb.
Rosa Marretii Levl.
Lonicera Morrowii A. Gray.

Trees :

Quercus dentata Thunb.
Malus baccata Borkh. var. *mandschurica* C. K. Schn.

It will be appreciated at once how closely the plants in the list conform with the common sandy-beach species of Honshu and Saghalien.

In places where there is a wide space of fairly level ground adjoining the sandy-beach, it is not unusual to find a belt of broad-leaf woodland within the zone of maritime influence. This belt is usually composed of *Quercus dentata*, and notable examples are to be seen in the vicinity of Zenibako on the coast of Ishikari Province; along the Kitami coast washed by the Okhotsk Sea, especially towards the northerly end, *Quercus mongolica* often occurs under similar conditions. The dominant species in such surroundings shows a very characteristic form of growth, the trees being all stunted and attaining a uniform height. This tendency towards nanism is seen to advantage along the Pacific coast of Hidaka Province, where *Quercus dentata* is remarkably dwarfed, attaining only a few feet in height with crooked stems and branches. *Quercus grosseserrata* and *Ostrya japonica* may also occur in these woodland belts, their growth being likewise stunted to conform with that of the dominant species.

A characteristic feature of the sandy-beach vegetation that deserves special mention is the shrubby growth of *Rosa rugosa*. This species is

found everywhere along the coast of Yezo in great abundance; it grows 1–2 feet in height in dense clumps, or even thickets several acres in extent, and is very conspicuous with its large crimson flowers, rugous leaves and densely spinous stems and branches.

Sand-dunes are frequent along the coast of Yezo, and afford material of exceptional interest for the study of physiographic ecology. Following the line of the sandy-beach, sometimes in a double or even triple row, they seldom rise to more than 20 feet above the level of the sea, but in some places, such as on the Okhotsk coast of Kitami Province between Abashiri and Shari, they attain to a hundred feet or more. Behind these dunes there are moist depressions where hygrophytic elements are represented. As regards the vegetation of the sand-dunes themselves, the species are the same as in the list given for the sandy-beaches, but the combination varies according to locality.

The Vegetation of the Rocky Shore. There is usually a pronounced zonal arrangement of plant-associations on rocky coasts. Between low and high tide levels the rocks, if their base remains permanently submerged, are mostly plastered with sea-weeds; above high tide level is a zone of varying width barren of all vegetation on account of the action of waves; higher up is a zone in which the vegetation consists of a group of hardy xerophytes; and above this again there is often a mixed association established on the face of the cliff and the rubble slope at its foot which includes the xerophytes as well as inland species (in greater or less proportion according to the moisture) and also one or two species peculiar to maritime escarpments and cliff-slopes, such as: *Polystichum falcatum* Diels, *Juniperus Sargentii* Takeda, *Sedum roseum* Scop. vars., and *Draba borealis* DC. Besides these, the following are the few very characteristc species peculiar to the rocky shore:—*Tetragonia expansa* Murr., *Spergularia salina* Presl., *Ammodenia major* Kudo, *Atriplex patula* L., *Cochlearia oblongifolia* DC., *Cnidium japonicum* Miq., *Ligusticum scoticum* L., *Lysimachia mauritiana* Lam., *Apocynum venetum* L., *Chrysanthemum arcticum* L. vars. and *Chrysanthemum Weyrichii* Miyabe et Miyake var. *littorale* Kudo.

The thick leaves of these plants show that they are adapted to withstand drought as well as the impact of spray and strong winds. Among these species, two are of southern origin and confined in Yezo to the south-western districts, namely *Polystichum falcatum*, with its north-western limit of distribution on the east coast of Okushiri Island and its north-eastern on the Pacific coast of Hidaka Province, and *Tetragonia expansa*, which grows only in one spot in Oshima Province near Hako-

date. Omitting the foregoing anomalies, the vegetation of the rocky coast is specifically boreal in character, and its outstanding feature is the distribution of boreal species on the Pacific side. For instance, *Chrysanthemum arcticum* originating in North-eastern Asia (where it has hairy stems), comes down along the Pacific coast of Yezo and continues as far south as the peninsula of Shimokita, in the province of Mutsu, represented by glabrous varieties. This mode of distribution, other examples of which could be cited, is attributable to the "Oyashiwo," the strong continuous cold current which flows along the Pacific coast of Yezo. The only other species of the genus *Chrysanthemum* is confined to a single locality at Oshoro, a village on the coast of Shiribeshi Province. This plant, recently treated by T. MAEKAWA under the name of *Chrysanthemum littorale*, is so closely related to *Chrysanthemum Weyrichii* of Saghalien that my own inclination was to regard it as a variety of this latter species which had become glabrous in its migration southward in the same way as our varieties of *Chrysanthemum arcticum*.

The Vegetation of the Salt Marshes. True salt marshes, *i. e.*, marshy tracts which are inundated with more or less frequency by tide, occur here and there along the coast of Yezo. The vegetation consists mainly of plants which delight in a saline soil, the commonest being *Triglochin maritimum* and *Glaux maritima*. Other characteristic species frequenting such situations are *Salicornia herbacea*, *Carex subspathacea*, *Carex scabrifolia*, and *Festuca thalassica*.

5. Vegetation of Bogs and Swamps.

It is not intended to suggest that a hard and fast distinction can be drawn between the meaning of the two words "Bog" and "Swamps," but it is convenient to make some such general division, reserving the term "Bog" for that type of more or less waterlodged area which is characterised by a spongy surface composed of a greater or less proportion of Bog-moss (*Sphagnum*).

Bogs. Bogs cover a large area in the north of Europe and continental Asia, and are also distributed over the northern part of the North American Continent. They are well developed in Saghalien, where they are known by the Russian name "Tundra," but in Japan Proper they are almost confined to the northern half, and Yezo is the only part where extensive tracts occur. The influence of climate on the formation and maintenance of Yezo Bogs is a subject on which very little has been written, but it seems reasonable to suppose that the

limited distribution in Japan is not unconnected with the climatic conditions which prevail in Yezo in contra-distinction to South Japan, namely abundance of precipitation, cool nights in summer and relatively low proportion of humidity in the atmosphere.

In Yezo bogs are found to a limited extent on plains and also here and there along the coast, where edaphic conditions are peculiarly favourable, at only a few feet above sea level, but most of the extensive tracts occur in the vicinity of the larger rivers such as the Ishikari and Teshio on the Japan Sea watershed, the Tokachi, Kushiro and Akan on the Pacific watershed and the Sarupet, Tompet, Shipet, Nishipet and Huren on the Okhotsk Sea watershed. The largest area of all is found about the centre of Ishikari Province, in the watershed of the river of that name, where the principal bogs are one near Bibai (about 24,000 acres in extent), another near Tsuishikari (about 9,800 acres) and a third near Horomui of some 4,900 acres. Another important area, covering more than 51, 450 acres, stretches along the Teshio River between Kokkunep and Onupnai. Good examples of boggy formation on a smaller scale have recently come to my notice three miles east from Oshamanbe railway station at Shizukari in Iburi Province and close to Biwase in the vicinity of Kiritapp, both being close to the coast and almost at sea-level.

Given the requisite climatic and topographical conditions, a further essential for the maintenance of the typical plant-association of a bog is the presence of some species of *Sphagnum*, which, when well established, acts like a sponge and helps to prevent dehydration. If, however, channels of sufficient depth are cut through a bog, the *Sphagnum* quickly dies and the area is soon converted into dry land suitable for cultivation, for which reason the extent of Yezo bog-land is dwindling from year to year.

The bogs of Yezo may be divided into three different types, the Boggy Meadow, the Wet Bog and the *Phragmites* Bog.

In the Boggy Meadow the cushion-forming *Sphagnum* is inconspicuous, and grasses, sedges and *Osmunda cinnamomea* predominate. The peat, which may be anything from a foot to ten feet deep, is quite compact and usually consists of the remains of sedges, grasses and ferns. Woody plants are represented by a scattered and comparatively inconspicuous growth of low shrubs. Of the characteristic species listed below, *Hemerocallis Middendorffii* is perhaps the most commonly conspicuous flower.

Dryopteris Thelypteris A. GRAY.
Osmunda cinnamomea L.
Osmunda regalis L. var. *japonica* MILDE.
Dimeria ornithopoda TRIN.
Calamagrostis villosa MUTEL.
Molinia speculosa KUDO.
Carex Lyngbyei HORNEM.
Carex Middendorffii FR. SCHM.
Veratrum album L. var. *Lobelianum* RCHB.
Veratrum stamineum MAXIM.
Hemerocallis Middendorffii TRAUTV. et MEY.
Heloniopsis pauciflora A. GRAY.
Aletris foliata KUDO.
Habenaria sagittifera RCHB.
Clematis fusca TURCZ. var. *yezoensis* MIYABE.
Viola verecunda A. GRAY.
Lysimachia vulgaris L.
Lysimachia clethroides DUBY.
Lycopus lucidus TURCZ.
Lycopus Maackianus KOM.

In the Wet Bog the outstanding feature is the abundance of *Sphagnum* and the relative unimportance of vascular species. Of the *Sphagnums*, mesophytic species usually preponderate, but the more xerophytic cushion-forming species are also found as well as those of aquatic or semi-aquatic habit. *Sphagnum acutifolium* EHRH., *Sphagnum cymbifolium* EHRH., *Sphagnum fuscum* KLINGER, and *Sphagnum Girgensohnii* RUSS. are all common. As regards vascular plants the Wet Bog differs from the Boggy Meadow in supporting a more abundant growth of shrubs, among which the comparatively xerophytic *Vacciniums* and *Empetrum* are remarkable, ericaceous undershrubs being conspicuously abundant. These species grow on the cushion-forming *Sphagnums*, and the vegetation of the wetter depressions is markedly different. In the list of characteristic vascular plants given below, the following symbols are used : ± to denote species widely distributed over the Holarctic region, * for those distributed over Eastern Asia, (J) for those confined to the Japanese Archipelago including the island of Saghalien, (Y) for those peculiar to Yezo.

± *Lycopodium inundatum* L.
± *Triglochin palustre* L.
± *Scheuchzeria palustris* L.
± *Eriophorum alpinum* L.
± *Eriophorum vaginatum* L.
± *Eriophorum gracile* KOCH.
± *Rynchospora alba* VAHL.
(J) *Rynchospora Umemurae* MAKINO var. *exigua* TAKEDA.
(J) *Rynchospora Miyakeana* MAKINO.
(J) *Rynchospora Fauriae* FRANCH.
± *Carex pauciflora* LIGHT. f.
± *Carex Lyngbyei* HORNEM.
* *Carex Middendorffii* FR. SCHM.
* *Carex Gmelini* HOOK. et ARN.
± *Carex limosa* L. var. *fusco-cuprea* KUK.
Carex Michauxiana BOECK.
(Y) *Eriocaulon monococcos* NAKAI.
(Y) *Juncus Tokubuchii* MIYABE et KUDO.
Iris sibirica L.
Iris setosa PALL.
* *Iris Kaempferi* SIEB.
(J) *Gymnadenia Kinoshitai* MAKINO.
* *Pogonia japonica* RCHB.
* *Arethusa japonica* A. GRAY.
± *Myrica Gale* L. var. *tomentosa* A. DC.
± *Coptis trifolia* SALISB.
± *Drosera rotundifolia* L.
± *Drosera anglica* HUDS.
± *Parnassia palustris* L.
± *Rubus Chamaemorus* L.
± *Comarum palustre* L.
Lathyrus palustris L. vars.
± *Empetrum nigrum* L.
(J) *Rhus trichocarpa* MIQ.
* *Ilex crenata* THUNB.

|* *Hypericum crassifolium* Nakai.
Viola Langsdorffi Fisch.
* *Epilobium palustre* L.
* *Ledum palustre* L. vars.
* *Andromeda polifolia* L.
* *Chamaedaphne calyculata* Moench.
* *Oxycoccos palustris* Pers.
* *Vaccinium Vitis-idaea* L.
* *Trientalis europaea* L. vars.
Gentiana triflora Pall.
* *Menyanthes trifoliata* L.
* *Polemonium coeruleum* L. var. *racemosum* Miyabe et Kudo.
(J) *Scutellaria yezoensis* Kudo.
(J) *Rubia jesoensis* Miyabe et Miyake.
(J) *Aster rugulosus* Maxim.

It is easily noted from the figures mentioned above that the 27 species or 54 % of the total number of the moor species recorded in Yezo are widely distributed over the cold regions of Asia, Europe and North America. These holarctic species are mixed by East-Asiatic, Japanese and Saghalien species, which give a special characteristic to the vegetation of the Yezo moors.

The commonest type of all is the *Phragmites* Bog, which extends for miles along many of the Yezo rivers and streams, as, for instance, in the basins of the Ishikari and Tokachi Rivers, and is also encountered in the neighbourhood of lakes. These bogs are only raised a foot or two above the level of the neighbouring water during the summer and are liable to inundation at flood-time, when a certain amount of gritty sediment is deposited and becomes infiltrated throughout the layer of peat which covers the soil. A very characteristic but exceedingly monotonous vegetation of a grass-like type results from these conditions, the main element being *Phragmites communis*, while *Molinia* is locally abundant, and the two together often form an exclusive association of extensive area. Woody species are absent or very scantily represented, and the only additional vascular plants commonly met with are :

Zizania aquatica L.
Carex vesicaria L.
Dimeria ornithopoda Trin.
Juncus Krameri Fr. et Sav.

Swamps. Swamps are found on the plains, in the forests, along the banks of streams, especially the smaller brooks, and in various other surroundings. The typical features of their vegetation are the comparatively few though very characteristic seed-plants, and the presence of a few species of deciduous trees such as *Fraxinus mandschurica*, *Alnus japonica* var. *arguta*, *Acer Ginnala* and *Acer Miyabei*, as well as the absence of practically all Conifers with the exception of Glehn's Spruce. The white spathes of *Lysichiton* are very conspicuous in spring, and the plant retains its prominence throughout the summer on account of the enormous size of its leaves. The common characteristic herbaceous components of the Swamp vegetation are as follows :—

Equisetum palustre L.
Equisetum Heleocharis Ehrh.
Alisma Plantago L.
var. *canaliculatum* Kudo.
var. *parviflorum* Torr.
Sagittaria Aginashi Makino.
Sparganium ramosum Huds.
Sparganium stenophyllum Maxim.

Sparganium glomeratum Laest.
Sparganium affine Schnizl.
Scirpus mucronatus L.
Scirpus erectus Poir.
Scirpus Tabernaemontani Gmel.
Scirpus radicans Schk.
Eleocharis palustris R. Br.
Eleocharis Savatieri Clarke.
Eleocharis tetraquetra Nees.
Calla palustris L.
Monochoria Korsakovii Rgl. et Maack.
Monochoria vaginalis Presl.
Hosta japonica Aschers.
form. *coerulea* Kudo.
form. *lancifolia* Kudo.
Caltha palustris L. form. *gigas* Levl.
Hippuris vulgaris L.
Cicuta virosa L.
Sium cicutaefolium Gmel.
Naumburgia thyrsiflora Duby.
Caryopteris divaricata Maxim.
Lycopus parviflorus Maxim.
Lycopus japonicus Matsum. et Kudo.
Lobelia sessilifolia Lamb.

Where dehydration is in progress the more water-loving species quickly tend to disappear, but the more accommodating plants may endure for a number of years after the swamp has become dry, taking refuge in the depressions and only gradually becoming superseded by another type of vegetation.

6. Riparian and Lake-side Vegetation.

The riparian vegetation of Yezo offers great variety according to the formation of the banks or shores, the natural features of the country, the volume of water, *etc.* For instance along the banks of the larger rivers there is usually a conspicuous absence of the aquatic mosses and liverworts which flourish by the smaller streams.

The banks of rivers and streams fall naturally into two categories, rocky banks and muddy, gravelly or sandy shores, both of which may be seen in most parts of Yezo.

Rocky banks exist under varying conditions, with corresponding variations in the typical vegetation : sometimes they are dry, sometimes they are kept moist by running water ; in some places they are so smooth that little or no vegetation can exist on them, while in others the rifts and crevices harbour sufficient soil to maintain plant life. On rocky banks which are kept moist by a constant flow or trickle, we find the mosses and liverworts, and, rooted in mossy covering, hydrophytes and mesophytes such as,

Oxyria digyna L.
Wasabia japonica Matsum.
Cardamine yezoensis Maxim.
Cardamine Fauriei Franch.
Chrysosplenium flagelliferum Fr. Schm.
Chrysosplenium kamtschaticum Fisch.
Tiarella polyphylla Don.
Waldsteinia sibirica Tratt.
Oxalis Acetosella L.
Epilobium palustre L.

The hardy species that maintain a foot-hold in the crevices of rocky cliff-banks and among the dry boulders of stream-beds are not limited

to herbs but may include small trees such as *Betula japonica*. The plants most commonly found in these surroundings are :—

Hymenophyllum Wrightii V. D. Bosch.
Woodsia polystichoides Eat.
Polypodium vulgare L.
Calamagrostis sachalinensis Fr. Schm.
Melica nutans L.
Sedum roseum Scop. var. *elongatum* Kudo.
Sedum kamtschaticum Fisch.
Sedum Aizoon L.
Cotyledon malacophylla Pall.
Saxifraga yezoensis Engl.
Draba sachalinensis Fr. Schm.

These species, however, only occur here and there where there is sufficient soil to sustain them, and cannot ever be said to form decided groups or associations.

Along the rivers and streams the banks are usually low and of the muddy type. Where they are normally inundated at flood-time, the vegetation is a wet-marsh association comprising sometimes the following prominent consociations: Hippurietum vulgaris, Equisetetum Heleocharis, Montictum rivularis.

Where the inundation is less frequent or less complete, the following are usual :

Equisetum arvense L.
Carex flaccidior Miyabe et Kudo.
Chrysosplenium Grayanum Maxim.
Angelica refracta Fr. Schm.
Primula japonica A. Gray.
Primula cortusoides L.
Veronica americana Schwerin.
Petasites japonicus Miq.
var. *giganteus* Makino.

Some of these, notably *Petasites japonicus* var. *giganteus*, are not infrequently found on the flood-plain in exclusive association.

Sandy or gravelly shores of the rivers and streams are also found. Usually there is only a sparse vegetation, quite distinct from that of a muddy shore, comprising such species as :

Galium verum L.
Gnaphalium multiceps Wall.
Artemisia vulgaris L. var. *kamtschatica* Bess.
Anaphalis yedoensis Matsum.
Rumex Acetosella L.

The lakes of Yezo are bordered by muddy or sandy banks, and in some cases rocky cliffs descend sheer to the water's edge and the forests extends to the edge of the cliff. The eastern shore of Lake Akan is a typical example of such formation, and the cliff being lapped by the water at its base and crowned by a magnificent forest of firs. The vegetation of such cliffs is approximately the same as that of the rocky banks of streams.

On the muddy shores of lakes *Montia rivularis*, growing in very shallow water, sometimes covers wide areas with a pale green carpet, and

most of the species belonging to the swamp association may also be found represented.

On the sandy shores around the lakes of Yezo, there is only a sparse vegetation, quite similar to that of a sandy shore of the streams.

7. Aquatic (fresh-water) Vegetation.

There are numerous natural and permanent lakes scattered over the island of Yezo, the best known being Onuma and Konuma, Junsai, Toya, Shikotsu, Akan, and Kutcharo. Their aquatic vegetation is distributed more or less in zones according to the depth of water, green plants being absent from the greater depths where insufficient light penetrates, while phanerogamic species in particular grow best in comparatively shallow parts. The principal elements of the plant-associations are on the whole remarkably constant, not only throughout Yezo but also for the whole Temperate Zone of Asia, Europe and North America. In Yezo lakes the following species are more or less common :—

Potamogeton natans L.
Potamogeton polygonifolius POURR.
Potamogeton alpinus BALB.
Potamogeton gramineus L.
var. *heterophyllus* FRIES.
Potamogeton perfoliatus L.
Potamogeton praelongus WULF.
Potamogeton crispus L.
Potamogeton compressus L.
Potamogeton oxyphyllus MIQ.
Potamogeton pusillus L.
Potamogeton Maackianus A. BENN.
Najas marina L.
Hydrilla verticillata ROYLE.
var. *Roxburghii* CASP.
Vallisneria spiralis L.
Spirodela polyrhiza SCHLEID.
Polygonum amphibium L.
Nuphar japonicum DC.
Tillaea aquatica L.
Trapa natans L.
Myriophyllum spicatum L.
Utricularia japonica MAKINO.

Besides the above, in the western half of the island *Brasenia Schreberi* and *Nymphaea tetragona* are not uncommon and *Potamogeton cristatus* and *Myriophyllum ussuriense* occur locally, while *Nuphar pumilum* grows only in the north-eastern section, and *Ceratophyllum demersum*—a common aquatic species in many parts of the northern hemisphere—has only been found in lakes of Kushiro Province.

Among Cryptogams found in the lakes of Yezo, perhaps the most interesting is *Cladophora Souteri* (*Aegagrophila Souteri*), a North European species, which Mr. KAWAKAMI found in 1897 growing in small limited areas near the margin of Lake Akan (Kushiro Province) in depth from 3 to 15 feet, and which is not only hitherto unrecorded elsewhere in the Japanese Archipelago but also unknown on the Con-

tinent of Asia. Others deserving of mention are *Chara*, represented by several common species, and *Isoetis echinosporum* Dur. which occurs in Lake Kuttara, Akan and Kutcharo.

8. The Shrub and Alpine Meadow Zone.

The zonal distribution of mountain vegetation is one of the most conspicuous features of the sub-region "North and Middle Japan" belonging to the Temperate East Asiatic Region. Above the Forest Zone we usually find one of Shrubs and Alpine Meadow which, in Yezo, begins at an altitude of 3,000 to 4,000 feet.

The two plant-associations of this Zone often intercross, and topography as well as the influences of climate and soil, seem to play an all-important part in determining their distribution. The woody species of the Shrubby Zone are all shrubby: the two which almost always predominate are *Pinus pumila* and *Betula Ermani*, while here and there are found *Alnus Maximowiczii*, *Sorbus sambucifolia*, *Acer Tschonoskii* and *Sorbus Matsumurae*, all usually associated with *Betula Ermani* to form a deciduous shrubbery.

Pinus pumila has a peculiar form of growth: it has no trunk, the main branches are prostrate and creeping, the lateral branches are ascending or ascending-spreading to an average height of 5–10 feet, producing a dense tangle which forms so deep a shade that only a few shade-loving alpine plants can live in it. This Dwarf Pine is widely distributed from Kamtschatka eastwards to Yakutsk and southwards through the Amurland to Manchuria and Korea on the continent, also through Yezo, Saghalien and the Kuriles and in the Alps of Honshu. In Yezo it covers a collective area of probably more than a hundred square miles, and is abundant on the summits and upper slopes of all the higher mountains, even volcanoes of recent activity, whereas in Honshu it is not found on active or recently active volcanoes. In the Shrubby Zone of Yezo mountains, it forms almost pure thickets, normally 5–10 feet in height and so dense as to be all but impenetrable. In some places it grows with scrubby bushes of *Rhododendron chrysanthum*, *Acer Tschonoskii*, *Sorbus sambucifolia*, *Prunus kurilensis*, *Salix* spp., *Empetrum nigrum* and other alpine plants; very rarely, among dense thickets of dwarf *Sasa* or other aggressive shrubs or in localities where strong winds are of rare occurrence, it is found growing in the form of small tree.

The Alpine Meadow association covers a comparatively small area

in Yezo, but is one of the most distinctive and includes many interesting species. It does not form a special zone on the mountain-side, occurring in patches within the Shrubby Zone where the exposure is such as to prevent the development of a mesophytic type of vegetation. Many of its species penetrate as undergrowth among the shrubs, and in an ecological survey of the Alpine Meadows in Yezo it is important to note the fact that they are linked with the Shrubby Zone through a series of intermediate stages. The seed-plants of the Alpine Meadow are small shrubs or perennial herbs of the type commonly referred to collectively as alpine plants. Their growth is scattered, matted, or tufted according to the nature of the ground, which may be rocky, moss-grown, gravelly, more or less swampy, *etc.*

The mountains on which the Alpine Meadow is well developed are Yeniwa, Tarumai, Yezo-fuji, Yubari, Taisetsu, Apoi, Pinneshiri, Tokachi, Me-Akan and Rishiri. Of these, only Yubari and the mountains of the Hidaka range are of Palaeozoic formation, the others being volcanoes, most of them extinct, but some still showing occasional activity, in particular Tarumai and Me-Akan.

The following table gives a list of the characteristic arctic-alpine species of Yezo, showing their recorded occurrence on the principal peaks or ranges. In the list, the following symbols are used: (C) to denote species or varieties chiefly distributed over the circumpolar regions, (J) for those mostly confined to the Japanese Archipelago, (O) for those distributed along the coastal regions of Okhotsk Sea, (B) for those originated from Behring-Sea region including Alaska and Aleutian Islands, (E) for those peculiar to Yezo.

Species \ Mountain	Komagadake.	Makkarinupuri.	Tarumai.	Yeniwa.	Yubari.	Ashiupet.	Taisetsu.	Tokachi.	Satsunai.	Apoi.	Me-Akan.	Rishiri.	Rebun.
Woodsia ilvensis R. Br. (C)	·	·	·	·	·	·	·	·	·	·	·	+	
var. *eriosora* Kudo.	·	·	·	·	+	+							
Lycopodium sitchense Rupr.	·												
var. *nikoense* Takeda. (J)	·	+	·	·	+	·	·	+					
Selaginella Selaginoides Link. (C)	·	·	·	·	+	+							
Hierochloe alpina Roem. et Schl. (C)	·	·	·	·	+	+							
Phleum alpinum L. (C)	·	·	·	·	·	·	+						
Agrostis flaccida Hack. (J)	+	+	·	+	+	+	+	+	·	·	·	+	+
Calamagrostis urelytra Hack. (J)	·	·	·	·	·	·	·	·	·	·	·	+	
var. *parvigluma* Takeda.	·	·	·	·	+	+							
var. *pumila* Takeda.	·	·	·	·	·	·	+	+					

Species \ Mountain	Komagadake.	Makkarinupuri.	Tarumai.	Yeniwa.	Yubari.	Ashiupet.	Taisetsu.	Tokachi.	Satsunai.	Apoi.	Me-Akan.	Rishiri.	Rebun.
Deschampsia flexuosa Trin. (C)	·	+	·	+	·	·	+	+	·	·	·	+	+
Trisetum subspicatum P. Beauv. (C)	·	·	·	·	+	·	·	·	·	·	·	+	
Trisetum leve Takeda. (E)	·	·	·	·	+								
Eriophorum Scheuchzeri Hoppe (C)	·	·	·	·	·	·	+						
Scirpus caespitosus L. (C)	·	·	·	·	+	+	+						
Scirpus Maximowiczii Clarke (J)	·	·	·	·	+								
Carex hakkodensis Franch. (J)	·	·	·	·	+	+							
Carex pyrenaica Wahlb. (C)	·	+											
Carex Mertensii Prescott. var. *urostachys* Kük. (J)	+	·	·	+	+	+	·	·	·	·	+		
Carex flavocuspis Franch. (J)	·	+	·	·	+	·	+	+	·	·	·	+	
Carex stenantha Fr. et Sav. (J)	·	·	·	+	·	·	+						
Carex capillaris L. (C)	·	·	·	·	+								
Luzula spadicea DC. var. *Wahlenbergii* Buch. (C)	·	·	·	·	·	·	+	·	·	·	·	+	
Juncus filiformis L. var. *curvatus* Kudo. (J)	·	+	·	·	+	+	·	·	·	·	·	+	
Juncus behringensis Buch. (B)	·	·	·	·	·	+	+	+					
Juncus triglumis L. (C)	·	·	·	·	·	·	+						
Tofieldia Okuboi Makino (J)	·	·	·	·	+	+	·	+					
Tofieldia Kondoi Miyabe et Kudo (E)	·	·	·	·	·	·	·	·	·	+			
Tofieldia fusca Miyabe et Kudo (E)	·	·	·	·	+	+	·	·	·	·	·	+	
Allium Schoenoprasum L. var. *orientale* Rgl. (O)	·	·	·	·	+								
Allium strictum Schrad. (C)	·	+	·	·	·	+	·	·	·	·	·	+	
Platanthera Chorisiana Rchb. f. (B)	·	+											
Polygonum Bistorta L. var. *vulgare* Meisn. (C)	·	·	·	·	+	+	·	·	·	·	·	+	+
Polygonum viviparum L. (C)	·	·	·	·	+	+	+	·	·	·	·	+	
Polygonum polymorphum L. var. *ajanense* Rgl. et Til. (O)	·	+	·	·	+	·	+	·	·	·	+	+	
Stellaria ruscifolia Willd. (O)	·	+	·	·	·	·	·	+	·	·	·	+	
Stellaria florida Fisch. var. *angustifolia* Maxim. (J)	·	·	·	·	·	+	+	·	+				
Alsine verna Bartl. var. *borealis* Fenzl. (C)	·	·	·	·	+	·	·	·	·	+			
Alsine arctica Fenzl. (C)	·	·	·	·	+	·	·	·	·	·	·	+	+
Arenaria Katoana Makino (J)	·	·	·	·	+	+							
Arenaria merckioides Maxim. (J)	·	·	·	·	·	·	·	·	·	·	+		
Aquilegia flabellata S. et Z. (J)	·	+	·	·	+	+	·	·	·	+	+	+	+
Anemone Taraoi Takeda. var. *nipponica* Takeda. (J)	·	·	·	·	·	+	·	·	·	·	·	+	
Papaver nudicaule L. var. *Fauriei* Kudo. (J)	·	·	·	·	·	·	·	·	·	·	·	+	
Dicentra peregrina Makino var. *pusilla* Makino (J)	·	·	·	·	·	·	+	+	·	·	+		
Cardamine nipponica Fr. et Sav. (J)	·	+	·	·	·	+	+	+					
Draba japonica Maxim. (J)	·	·	·	·	+								
Sedum Ishidae Miyabe et Kudo. (E)	·	·	·	·	+	+	·	+					
Boykinia lycoctonifolia Engl. (J)	·	+	·	·	+	+	·	·	+	·	·	+	
Saxifraga laciniata Nakai et Takeda (J)	·	·	·	·	+	+	·	+					
Saxifraga Nishidae Miyabe et Kudo (E)	·	·	·	·	+								

Species \ Mountain	Komagadake.	Makkarinupuri.	Tarumai.	Yeniwa.	Yubari.	Ashiupet.	Taisetsu.	Tokachi.	Satsunai.	Apoi.	Me-Akan.	Rishiri.	Rebun.
Saxifraga Merkii Fisch. var. *robusta* Takeda (E)	.	.	.	.	.	.	+						
Saxifraga bronchialis L. var. *cherlerioides* Engl. (B)	.	.	.	.	.	+	.	+	.	.	.	+	+
Potentilla fruticosa L. (C)	.	.	.	.	.	+	.	.	.	+			
Potentilla Miyabei Makino (J)	.	+	.	.	.	.	+	+	.	.	+		
Potentilla nivea L. (C)	.	.	.	.	+	.	.	.	.	.	.	.	+
Potentilla Matsumurae Wolf. (J)	.	+	.	.	+	+	+						
Geum calthaefolium Sm. var. *dilatatum* Torr. et Gr (B)	.	.	.	.	+	+	.	.	+				
Geum pentapetalum Makino (O)	.	.	.	.	+	+	+	+	+	+	.	+	
Dryas octopetala L. (C)	.	.	.	.	.	+							
Sanguisorba sitchensis Trautv. et Mey. (B)	.	.	.	.	+	+							
var. *rishirensis* Kudo	.	.	.	.	.	.	.	.	.	.	.	+	
Oxytropis pumilio Ledeb. (J)	.	.	.	.	.	.	+						
Oxytropis rishirensis Matsum. (E)	.	.	.	.	+	.	.	.	.	.	.	+	
Oxytropis megalantha Boiss. (E)	.	.	.	.	.	.	.	.	.	.	.	+	+
Geranium erianthum DC. (B)	.	+	.	.	+	+	.	+	+	.	+	+	+
Empetrum nigrum L. (C)	.	+	.	.	+	+	+	+	.	.	+	+	
Viola crassa Makino (J)	.	+	.	.	+	+							
Bupleurum triradiatum Adams, var. *alpinum* Rupr. (C)	.	.	.	.	.	+	.	.	.	.	.	+	+
Chidium ajanense Drude (O)	.	.	.	+	+	+	+	+	.	.	+	+	+
Rhododendron kamtschaticum Pall.(O)	.	.	.	.	+	+	+	+	+	+	+	+	
Loiseleuria procumbens L. (C)	.	.	.	.	+	+	+	+	.	.	+	+	
Phyllodoce tsugaefolia Nakai (J)	+	.	.	+	+	+							
Phyllodoce coerulea Balb. (C)	.	+	+	.	+	+	+	+	.	.	.	+	
Phyllodoce aleutica Makino (B)	.	.	.	.	+	+	+	+	+				
Bryanthus Gmelini Don (O)	.	.	.	.	+								
Cassiope lycopodioides Don (B)	+	+	+	+	+	+	+	+	.	.	.	+	
Cassiope Stelleriana DC. (B)	.	.	.	.	+	+	+	+					
Arcterica nana Makino (O)	.	+	+	+	+	+	.	.	.	.	+	+	
Arctous alpina Niedz. (C)	.	.	.	.	+	+	.	.	+	+	.	.	+
Vaccinium Vitis-idaea L. (C)	.	+	+	.	+	+	+	+	.	+	+	+	
Diapensia lapponica L. var. *obovata* Fr. Schm. (C)	.	+	+	+	+	+	+	+	.	.	+	+	
Primula yuparensis Takeda (E)	.	.	.	.	+								
Gentiana Makinoi Kusnez. (J)	.	+	.	+	+	+	.	.	.	+	+		
Gentiana Igarashii Miyabe et Kudo (E)	.	.	.	.	.	.	+						
Gentiana glauca Pall. (B)	.	.	.	.	.	.	+						
Gentiana nipponica Maxim. (J)	.	.	.	.	+	+	.	+					
Gentiana Kawakamii Makino (E)	.	.	.	.	.	+	.	.	.	.	.	+	
Gentiana auriculata Pall. (O)	.	.	.	.	.	.	.	.	.	.	.	+	+
Gentiana yuparensis Takeda (E)	.	.	.	.	+								
Swertia perennis L. var. *cuspidata* Maxim. (J)	.	.	.	.	+	+							
Fauria Crista-galli Makino (B)	.	+	.	.	+	+							
Mertensia rivularis DC. var. *japonica* Takeda (J)	.	.	.	.	+	+							
Pentstemon frutescens Lam. (B)	+	+	+	+	+	+	+	+	+	.	+	+	
Veronica Schmidtiana Rgl. (J)	.	+	.	.	.	.	.	.	.	.	.	+	
Veronica senanensis Maxim. (J)	.	.	.	.	+	.	.	.	+	+			

Species \ Mountain	Komagadake.	Makkarinupuri.	Tarumai.	Yeniwa.	Yubari.	Ashiupet.	Taisetsu.	Tokachi.	Satsunai.	Apoi.	Me-Akan.	Rishiri.	Rebun.
Lagotis glauca GAERTN. (C)	.	.	.	.	+	.	.	.	.	.	.	.	+
Pedicularis verticillata L. (C)	.	.	.	.	.	.	+						
Pedicularis Oederi VAHL. (O)	.	.	.	.	.	.	+						
Pinguicula vulgaris L. var. *macroceras* HERDER (C)	.	.	.	.	+	+							
Patrinia sibirica JUSS. (C)	.	+	.	.	+	+	.	.	.	+	.	+	+
Campanula dasyantha BIEB. (O)	.	.	.	.	+	+	.	+	.	.	.	+	+
Campanula lasiocarpa CHAM. (B)	+	+	+	.	.	.	.	+	.	.	+		
Erigeron Thunbergii A. GRAY var. *alpicolus* KUDO (J)	.	.	.	.	+	+							
Leontopodium discolor BEAUV. (J)	.	.	.	.	.	.	.	.	.	.	.	.	+
Anaphalis alpicola MAKINO (J)	.	.	.	.	.	.	.	.	.	+			
Artemisia norvegica FRIES (C)	.	+	.	.	+	+	.	.	.	.	.	+	
Arnica unalaschensis LESS. (B)	.	.	.	.	+	+	+	+	+				
Saussurea chinophylla TAKEDA (E)	.	.	.	.	+								
Saussurea Tilesii LEDEB. var. *Yanagisawae* KUDO (E)	.	+	.	.	+	+	+						
Picris crepioides MIYABE et KUDO (E)	.	.	.	.	.	.	.	.	.	+			
Crepis burejensis FR. SCHM. (O)	.	.	.	.	.	+	.	+	.	+	.	+	
Scorzonera radiata FISCH. var. *humilis* MIYABE et KUDO (J)	.	.	.	.	.	.	.	.	.	.	.	.	+

The vegetation of the alpine meadows of Yezo mountains is made up of 31 families divided into 70 genera and 108 species. These 108 more or less well marked floristic elements or units, which in various combinations make up the plant population of that part of the high mountain flora, have unequal ranges of distribution.

It appears that of the total number of species found in the alpine meadows of Yezo, 57 or 52.8 % are essentially of boreal nature; among these species, 33 are circumpolar: 13 are of the Behring-Sea region including Alaska and the Aleutian Islands: and the remainder or 11 species include plants present along the coastal regions of Okhotsk Sea.

We find then 35 species or 32.5 % of the total number of Yezo arctic-alpine species spread on the high mountains of Honshu or in the island of Saghalien or over the both. There are also 16 species which have been found only within the confines of the alpine meadows of Yezo.

The data presented above are of interest in attempting to arrive at some conclusion with regard to the colonization of the arctic or circumboreal species on the alpine meadows of Yezo.

9. The Tall-Grass Association.

I use this term to denote the vegetation of all those plains or uplands that are dominated by grasses of considerable height. These areas, though seldom extensive, are of frequent occurrence throughout the island of Yezo. The species characterising the tall-grass association are mostly perennial herbs, which attain their maximum development in the summer and wither away in the winter. Largest and most conspicuous is *Cacalia hastata* var. *glabra*, which is here in its optimum habitat and grows in great profusion. Similar in form, but never exceeding 9 feet in height, is *Senecio palmatus*, which is beautiful with its yellow flowers in autumn. *Petasites japonicus*, var. *giganteus*, 4 to 7 feet tall with huge orbicular leaves, is locally very abundant, often as an exclusive association. *Filipendula kamtschatica*, which attains a maximum height of 8 feet, is the Meadow-Sweet of Japan, with showy inflorescence, white or pale pink in colour. Many species of *Cirsium* grow to a considerable height, with purple heads large and small, nodding or erect. *Polygonum sachalinense* is very conspicuous with arcuate stems ten feet tall or more. These species occur in a variety of combinations depending on the nature of the soil and the configuration of the ground. This vegetation is not unlike that of the Savannah of the Tropics in its density and even height, but differs in the paler and mellower tones of the foliage and especially in the profusion of colour supplied by the flowers. The tall-grass association, which is one of the conspicuous types of vegetation in the northern parts of the Temperate East Asiatic Region, is not extensively developed in Japan except in Yezo and Saghalien.

10. Number and Distribution of all Species of Vascular Plants known to grow in Yezo.

In the absence of any taxonomic work covering the entire flora of Yezo, it seems desirable to give here a list of all the known species of Vascular plants. The first column of the list gives the names of the species, no distinction being made in respect of subspecies, varieties or forms even in cases where the original type is unknown in Yezo.

Columns 2 to 7 show the distribution of each species in different parts of Yezo and the Southern Kuriles, and the last 23 columns indicate the distribution in other regions.

Species / Region	Provs. Oshima and Shiribeshi	Provs. Iburi and Hidaka.	Provs. Ishikari and Teshio.	Provs. Kitami, Nemuro and Provs. Tokachi, Kushiro and	Provs. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	manchuria, Amur and Ussuri region.	China	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Trichomanes orientalis C. Chr.	+	·	+	·	·	+	·	·	+	+	·	·	+	+	·	·	·	·	·	·	·	·	·	+	·	·	+	·
Hymenophyllum Wrightii V. D. Bosch.	+	+	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Woodsia polystichoides Eat.	·	+	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *manchuriensis* Hook.	·	+	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *ilvensis* R. Br.	·	+	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cystopteris fragilis Bernh.	+	+	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Matteuccia, Struthiopteris Todaro.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *orientalis* Trev.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Onoclea sensibilis L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dryopteris Thelypteris A. Gray	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nipponica* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *oreopteris* Maxon.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *okuboensis* Miyabe et Kudo	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *tokyoensis* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *fragrans* Schott	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *setosa* Kudo	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *monticola* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *lacera* Ok.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Sabaei* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nutica* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Miqueliana* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *viridescens* Ok.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *amurensis* H. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *dilatata* A. Gray	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Phegopteris* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Lösneana* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *crenulato-serrulata* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *africana* C. Chr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·

Species / Region	Provs. Oshima and Shiribeshi.	Provs. Ishuri and Hidaka.	Provs. Ishikari and Teshio	Provs. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kurils.	Northern Kurils.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Tiukin and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Ophioglossum vulgatum L.	+	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	+	+	+	+	·	+	·	·	+	·	·	·	·
— *ruipponicum* Miyabe. et Kudo	·	+	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Botrychium simplex Hitch.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Lunaria* Sw.	·	·	+	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Matricariae* Spreng.	·	·	+	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *virginianum* Sw.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *strictum* Underw.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Equisetum arvense L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *sylvaticum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *palustre* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Heleocharis* Ehrh.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *hyemale* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *scirpoides* Michx.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lycopodium Selago L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *serratum* Thunb.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *cryptomerinum* Maxim.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *inundatum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *cernuum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *obscurum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *annotinum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *sitchense* Rupr.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *clavatum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *complanatum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Selaginella Selaginoides Link.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *rupestris* Spreng.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *helvetica* Link.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *involvens* Spr.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Isoëtes echinosporum Durieu.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Cephalotaxus drupacea S. et Z.	+	·	+	·	·	·	·	·	+	+	+	·	+																
Taxus cuspidata S. et Z.	+	+	+	+	+	+	+	+	+	·	+	+	+	·	·	·	·	·	·	·	·	·	+						
Abies sachalinensis Fr. Schm.	·	+	+	+	+	+	·	+																					
— *Mayriana* Miyabe et Kudo	+	+	+	+	+																								
Picea Glehni Mast.	+	+	+	+	+	+	·	+																					
— *jezoensis* Carr.	·	+	+	+	+	+	·	+	+	·	+	+	·	·	·	+													
Larix dahurica Turcz.	·	·	·	·	·	+	·	+	·	·	+	+	·	·	+	+	+												
Pinus pentaphylla Mayr	+	+	·	·	·	·	·	·	+	·																			
— *pumila* Rgl.	+	+	+	+	+	+	+	+	+	·	+	+	·	·	+	+	+	+											
Thujopsis dolabrata S. et Z.	+	·	·	·	·	·	·	·	+	+																			
Juniperus rebunensis Kudo	·	+	+	+	+	+	·	+																					
— *conferta* Parl.	+	·	+	+	+	·	·	+	+	+																			
— *Sargentii* Takeda	+	+	+	·	+	+	·	+	+																				
Typha latifolia L.	+	+	+	+	·	·		+	+		·	+	+	·	·	·	+	·	+	+	·	+	·	·	·	·	+	+	
— *orientalis* Presl.	·	·	·	·	·	·	·	·	+	+		+	+																
— *angustata* Bory et Chaubard	·	+	·	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	+	·	·	+	·	·	+	+	·		+
Sparganium ramosum Hudson	+	+	+	+	·	·	·	·	+	·	·	·	+	+	·	·	+	·	·	+	·	+	·	·	·	·	+		
— *stenophyllum* Maxim.	+	+	+	·	·	·	·	·	·	·	·	+																	
— *glomeratum* Laestadius.	+	+	+	+	+	·	·	+	+	·	·	·	·	·	·	·	·	·	+	+									
— *affine* Schnizl.	·	·	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+									
— *Borderi* Focke	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+									
— *minimum* Fries	·	·	+	·	·	+	·	·	·	·	·	·	·	·	+	·	+	·	+	+									
Zostera pacifica S. Watson	+	·	·	+	+	+	·	+	+	+	·	·	·	·	·	·	·	·	+										
— *nana* Roth.	+	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+		
Phyllospadix Scouleri Hook.	+	+	+	+	+	+	·	+	+	·	·	·	+	·	·	·	+	·	+										
Potamogeton natans L.	+	+	+	+	·	+	·	+	+	+	+	+	·	·	·	·	+	+	+	+	·	+	+	·	·	+	+	+	
— *javanicus* Hasskarl.	·	+	·	·	+	·	·	·	+	+	+	+	·	+	·	·	·	·	·	·	·	·	+	·	+	+	+	+	
— *cristatus* Rgl. et Maack.	·	·	+	·	·	·	·	·	+	·	+	+	+	·	·	·	·	·	·	·	·	·	+						
— *Tepperi* A. Benn.	·	·	·	·	+	·	·	·	+	·	+	·	+	·	·	·	+	·	·	·	·	·	+	·	·	+	·	+	
— *indicus* Roxb.	+	·	·	+	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	+	+	·	+	
— *polygonifolius* Pourr.	+	+	+	·	·	·	·	+	+	+	·	·	+	·	·	·	·	·	+	+	·	·	+	·	+	+	+	+	
— *alpinus* Balbis.	·	+	+	+	·	·	+	+	·	·	·	+	·	+	·	·	+	+	+	+	·	+	·	·	·	·	+		
— *malainus* Miq.	·	·	·	·	+	·	·	·	+	+	·	·	+	+	·	·	·	·	+	·	·	·	+	·	+				
— *gramineus* L.	·	+	·	+	·	·	·	+	+	·	+	·	·	·	·	·	·	·	+	+	+								
— *perfoliatus* L.	+	·	·	+	+	+	·	+	+	+	+	+	·	+	·	·	+	+	·	+	+	·	·	·	·	·	·	+	
— *praelongus* Wulf.	+	+	·	+	+	+	·	·	·	·	·	·	·	·	·	·	+	·	·	+	+								
— *crispus* L.	+	·	·	+	·	·	·	·	+	·	+	+	·	+	+	·	·	+	·	+	+	·	·	+	·	·	+	+	+
— *compressus* L.	+	+	·	+	·	·	·	·	+	·	·	+	·	·	·	·	·	+	·	+	+								
— *oxyphyllus* Miq.	+	+	·	·	·	·	·	·	+	+	+																		
— *pusillus* L.	+	+	+	+	·	·	·	+	+	+	+	+	+	·	·	·	·	·	+	·	+	+	·	·	+	·	·	·	+	+
— *pectinatus* L.	·	·	·	+	·	·	·	+	+	+	·	·	+	+	·	+	·	+	+	+	·	·	+	·	·	+	+	+	
— *Maackianus* A. Benn.	+	·	·	+	+	·	·	·	+	·	+	+																	

Species	Provs. Oshima and Shiribeshi.	Provs. Ishikari and Tesshio.	Provs. Ishuri and Hidaka.	Provs. Iburi, Yokawi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Linkin and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Najas maria L.	+	·	+	+	·	·	·	·	+	+	+	+	+	·	·	·	+	·	+	·	·	·	+	·	·	·	·	·
Triglochin maritimum L.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	·	·	+	·	+	·	·	·	+	·	·	·	·	·
— *palustre* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Scheuchzeria palustris L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Alisma Plantago L.	+	+	+	+	+	·	·	·	+	+	+	+	+	·	·	·	+	·	+	·	·	·	+	+	+	+	·	+
Sagittaria sagittifolia L.	·	·	+	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Aquashi* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Hydrilla verticillata Royle	·	·	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Vallisneria spiralis L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dimeria ornithopoda Trin.	·	·	·	·	·	·	·	·	·	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Imperata arundinacea Cyrill.	·	·	·	·	·	·	·	·	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Miscanthus sinensis Anders.	·	·	+	·	·	+	·	·	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonicus* Anders.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sacchariflorus* Benth. et Hook.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pollinia imberbis Nees	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nuda* Trin.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Spodiopogon sibiricus Trin.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *cotulifer* Hack.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Roiboellia latifolia Steud.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ischaemum anthephroides Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *mutieum* L.	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Arthraxon ciliaris Beauv.	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Zoysia pungens Willd.	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Arundinella anomala Steud.	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Paspalum Thunbergii Kunth.	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Isachne australis R. Br.	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Panicum sanguinale L.	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	·	·	+	·	·	·	+	·
— *Crusgali* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

— *Ischaemum* Schreb.	+	+	+	·	·	·	·	·	+	·	+	+	·	·	·	·	+	·	+	+	+	+							
— *acrantha* Steud.	+	+	+	+	·	·	·	·	+	+	·	·	+	+	·	·	·	·	·	·	·	·	+						
Oplismenus undulatifolius Beauv.	·	·	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	+	·	·	+	·	·	+	+		
Setaria glauca Beauv.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	+	+	·	+	+	·	·	+	+		
— *viridis* Beauv.	+	+	+	·	+	+	·	·	+	+	+	+	+	+	·	·	+	·	+	+	·	·	+						
— *pachystachys* Fr. et Sav.	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+						
Pennisetum purpurascens Makino	+	·	·	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+	+	·	·	·	+	
Zizania aquatica L.	+	+	+	+	·	·	·	·	+	+	+	+	·	·	·	·	+	·	+	·	·	·	+						
Leersia oryzoides Solander	·	·	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	+	+	·	+							
Phalaris arundinacea L.	+	·	+	+	+	+	·	+	+	+	+	+	·	·	·	+	+	·	+	+	·	+	·	·	·	+			
Anthoxanthum odoratum L.	+	·	·	·	+	·	·	+	+	·	·	·	·	·	·	·	+	·	+	+	·	+	·	·	·	·	+	+	
Hierochloe odorata Wahlb.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+	·	+	+									
— *alpina* Roem. et Schult.	+	·	+	·	·	·	·	+	+	·	·	·	+	·	+	+	+	·	+	+									
— *pluriflora* Koidz.	·	·	+																										
Stipa sibirica Lam.	+	+	+	·	·	·	·	+	+	·	+	+	+	+	·	·	+	·	+										
Muehlenbergia japonica Steud.	+	+	+	·	+	·	·	·	+	+	+	+	+																
— *Huegelii* Trin.	+	·	+	+	·	·	·	·	+	+	+	+	+	+															
Milium effusum L.	+	+	+	+	·	+	·	·	+	+	·	+	+	+	·	·	+	·	+	+	·	·	·	+					
Alopecurus fulvus Sm.	+	+	+	+	·	+	·	+	+	+	+	+	·	·	·	·	+	·	·	+	·	+	+						
Phleum alpinum L.	·	·	+	·	·	·	+	·	+	·	·	+	+	+	+	·	+	·	+	+	·	+	·	·	·	·	·	·	+
— *pratense* L.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	+	·	+	+									
Polypogon Higegaweri Steud.	+	·	·	·	·	·	·	·	+	+	+	·	+	+	·	·	·	·	·	·	·	·	+						
Agrostis alba L.	+	+	+	+	+	·	·	·	+	+	·	·	+	+	·	·	·	·	+	+	+								
— *flaccida* Hack.	+	+	+	+	+	+	+	+	+																				
— *scabra* Willd.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	·	·	+	·	·	·	+						
— *perennans* Tuck.	+	+	+	+	+	+	+	+	+	+	+	·	+	·	·	·	·	·	+										
Calamagrostis Epigejos Roth.	+	+	+	+	·	·	·	+	+	·	+	+	+	·	·	·	+	·	·	+	·	·	+	·	·	·	+		
— *Onoei* Fr. et Sav.	+	+	+	·	·	·	·	·	+																				
— *villosa* Mutel.	+	+	+	+	+	+	+	+	+	·	+	+	+	·	·	·	+	·	+	+									
— *stricta* Trin.	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	+	+	+										
— *sachalinensis* Fr. Schm.	+	+	+	+	+	+	·	+	+	·	+																		
— *hakonensis* Fr. et Sav.	+	+	+	+	+	+	·	+	+	+																			
— *robusta* Fr. et Sav.	+	·	·	·	·	·	·	·	+																				
— *arundinacea* Roth.	+	·	+	·	·	·	·	+	+	+	+	+	+	+	·	·	+	·	·	+									
— *urelytra* Hack.	·	·	+	·	+	+	+	·	+																				
Holcus lanatus L.	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+									
Deschampsia caespitosa P. Beauv.	·	+	·	+	·	+	+	+	+	·	·	+	+	+	+	·	+	·	+	+	·	+	+						
— *brevifolia* R. Br.	·	·	+	·	·	·	+	·	·	·	·	·	·	·	+	·	+	·	+	+									
— *atropurpurea* Scheele	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	+	·	+	+									
— *flexuosa* Trin.	+	+	+	+	+	+	+	+	+	·	·	·	·	·	·	·	+	·	+	+	·	+	+	·	+	·	·	·	+
Trisetum subspicatum P. Beauv.	·	·	+	+	+	+	+	+	+	·	·	·	+	+	+	·	+	+	+	+	·	+	+						
— *flavescens* P. Beauv.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	+	·	·	·	·	·	·	+		

Species / Region	Prov. Oshima and Shiribeshi.	Prov. Ishikari and Tesshio.	Prov. Ishikari and Hidaka.	Prov. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska, incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Trisetum leve Takeda	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cynodon Dactylon Pers.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Beckmannia eruceaformis Host.	·	+	+	+	+	·	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	·	·	·	·	·
Phragmites communis Trin.	·	+	+	+	+	·	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	·	·	·	·	·
— *prostratus* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Molinia spiculosa Kudo.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Eragrostis pilosa P. Beauv.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Melica nutans L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *striata* Hitch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·
Diarrhena japonica Fr. et Sav.	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Brylkinia caudata Fr. Schm.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dactylis glomerata L.	·	·	·	·	·	·	·	·	·	·	+	·	·	+	+	·	·	·	+	+	+	·	·	·	·	·	·	·
Poa annua L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pratensis* L.	·	·	·	·	·	·	·	+	+	+	·	·	+	·	+	·	·	·	+	+	+	·	·	·	·	·	·	·
— *nemoralis* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	·
— *acroleuca* Steud.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *palustris* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sphondylodes* Trin.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Chaixi* Vill.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *glumaris* Trin.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *stenantha* Trin.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *scabrifolia* Hack.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *cenisia* All.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Fauriei* Hack.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Glyceria aquatica Wahlb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *remota* Fries	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pallida* Trin.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *fluitans* R. Br.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

— *tongluensis* Clarke.	+	+	·	·	·	+	·	·	+	+	+	·	·	+															
Festuca thalassica Kunth.	·	+	+	+	+	+	·	+	+		·	+	·	·	·	·	+	+	+	+									
— *parvigluma* Steud.	+	+	+	·	·	·	·	·	+	+	+	·	+																
— *subulata* Bongard	·	+	+	+	·	·	·	·	+	·	·	·	·	·	·	·	·	+											
— *ovina* L.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	·	+	+	·	+	+	·	+							
— *rubra* L.	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	+	·	+	+	·	+	·	·	·	+	+		
— *elatior* L.	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	+									
Bromus ciliatus L.	+	+	·	+	+	+	·	+	·	·	+	+	·	·	+	+	·	·	+										
— *pauciflorus* Hack.	+	+	+	+	·	·	·	·	+	+	+	·	+	·	·	·	·	·	+										
— *mollis* L.	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	+	·	+	·	·	·	·	+		
— *secalinus* L.	·	·	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	+		
— *japonicus* Thunb.	+	+	·	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	+	·	+	·	·	·	+	+		
— *racemosus* L.	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+									
Brachypodium sylvaticum Beauv.	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	+		
— *japonicum* Miq.	+	+	+	+	+	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	+						
Lolium temulentum L.	·	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	+	·	+	+	·	+	·	·	·	·	+	+	+
— *perenne* L.	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	+	·	·	·	·	+	+	
Agriopyrum semicostatum Nees	+	·	+	+	·	·	·	·	+	+	+	·	+	+	·	·	·	·	·	·	·	+							
— *caninum* P. Beauv.	+	+	+	·	+	·	·	·	+	+	+	+	+	·	·	·	·	·	+	+									
— *repens* P. Beauv.	+	·	+	·	·	·	·	+	·	·	·	·	·	+	·	·	+	·	+	+	·	+	·	·	·	+	+		
Elymus mollis Trin.	+	+	+	+	+	+	+	+	+	·	·	+	·	·	+	+	·	+											
— *dahuricus* Turcz.	+	+	+	+	+	+	·	+	+	·	+	+	+	+	·	·	+												
— *sibiricus* L.	·	+	·	·	·	·	·	+	·	·	+	+	+	+	·	·	+	·	+										
Sasa borealis Makino et Shibata	·	+	·	+	·	·	·	·	+	+																			
— *nipponica* Makino et Shibata	·	+	·	·	·	·	·	·	+	+																			
— *paniculata* Makino et Shibata	+	+	+	+	+	+	·	+	+	+																			
— *nana* Makino	·	·	·	·	·	+	·	·	+																				
— *kurilensis* Makino et Shibata	+	+	+	·	+	+	·	+	+																				
Cyperus difformis L.	·	·	+	·	·	·	·	·	·	·	+	+	+	·	·	·	·	·	·	·	·	+	·	·	+	+			
— *truncatus* Turcz.	+	+	+	+	·	·	·	·	+	·	+	+	+	·	·	·	+												
Juncellus serotinus Clarke	+	+	+	+	·	·	·	·	+	+	·	+	+	·	·	·	·	·	·	+	·	·	+	·	·	+			
Pycreus sanguinolentus Nees	+	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+	+	·	+	+	+	
Kyllingia brevifolia Rottb.	+	+	·	·	·	·	·	·	+	+	+	+	·	·	·	·	·	·	·	·	·	·	+	·	+	+			
Eriophorum alpinum L.	·	+	+	+	·	·	·	·	·	·	+	·	·	·	·	·	+	·	+	+									
— *vaginatum* L.	+	+	+	+	+	+	+	+	+	·	+	+	·	·	·	+	+	·	+	+	·	+	·	·	·	·	·	·	+
— *Scheuchzeri* Hoppe	·	·	+	·	·	·	·	+	·	·	+	+	+	·	·	+	+	+	+	+									
— *gracilis* Koch	+	+	+	+	·	+	·	+	+	·	·	+	+	·	·	·	+	·	+	+									
Scirpus caespitosus L.	·	·	+	·	·	+	+	+	+	·	·	·	+	·	·	·	+	+	+	+									
— *mucronatus* L.	+	+	+	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	+	·	·	+	·	·	+	+	+	
— *erectus* Poir.	+	+	+	+	·	·	·	·	+	+	·	+	+	·	·	·	·	·	+	·	·	·	+	·	·	+	+	+	
— *triqueter* L.	+	+	+	+	·	·	·	·	+	+	·	+	·	·	·	·	·	·	+	+	·	+	+	·	·	+	+		
— *Tabernae-montani* Gmel.	+	+	+	+	·	+	·	+	+	+	·	+	·	·	·	·	+	·	·	+	·	+	+						

Species / Region	Prov. Oshima and Shiribeshi.	Prov. Ishuri and Hidaka.	Prov. Ishikari and Teshio	Provs. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Scirpus maritimus L.	·	+	+	·	+	·	·	·	+	+	·	+	+	·	·	·	+	·	·	+	·	·	+	·	·	+	+	
— *Maximowiczii* Clarke	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *Eriophorum* Michx.	·	+	+	+	·	+	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *radicans* Schkuhr.	·	+	+	+	+	+	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	
Bulbostylis capillaris Kunth.	·	+	+	+	+	+	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	
Eleocharis palustris R. Br.	·	+	+	+	+	+	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *Savatieri* Clarke	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *ovata* R. Br.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *acicularis* R. Br.	·	+	·	·	·	·	·	·	+	·	+	+	+	·	·	·	·	·	·	+	+	·	·	·	·	·	·	
— *japonicus* Miq.	·	+	+	+	·	+	·	·	+	+	+	+	+	·	·	·	·	·	·	+	+	·	·	·	·	·	·	
— *tetraqueter* Nees	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
Fimbristylis diphylla Vahl.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *subbispicata* Nees et Mey.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *squarrosa* Vahl.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
Rynchospora alba Vahl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *Umemurae* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *Miyakeana* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *Faurieae* Franch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
Carex hakkodensis Franch.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *rhizopoda* Maxim.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *Onoei* Fr. et Sav.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *rara* Boott	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *ida* Maxim.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *pyrenaica* Wahlb.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *paucifiora* Lightf.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *arenicola* Fr. Schm.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *pseudocurvata* Fr. Schm.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
— *pallida* C.A. Mey.	·	+	+	+	·	+	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	

— *nubigena* D. Don
— *stipata* Muehlenb.
— *chaendra* Schrank.
— *macrocephala* Willd.
— *Maackii* Maxim.
— *planata* Fr. et Sav.
— *canescens* L.
— *brachystachys* Fr. Schm.
— *brunnescens* Poir.
— *tenella* Schkuhr.
— *tenuiflora* Wahlb.
— *pseudotoliacea* Fr. Schm.
— *toliacea* L.
— *stellulata* Good.
— *laeviculmis* Meinsh.
— *remota* L.
— *pyramidalis* Miyabe et Kudo.
— *dissitiflora* Franch.
— *orbicularis* Boott
— *Gaudichaudiana* Kunth
— *Schmidtii* Meinsh.
— *caespitosa* L.
— *subspathacea* Wormsk.
— *semiplena* Kük.
— *aphyllopus* Kük.
— *heterolepis* Bunge
— *olaruensis* Franch.
— *forsicula* Fr. et Sav.
— *sadoensis* Franch.
— *incisa* Boott
— *pruinosa* Boott
— *cincta* Franch.
— *cernua* Boott
— *Fresdtiana* Boott
— *shimidzensis* Franch.
— *Lyngbyei* Hornem.
— *pruinocarpa* Franch.
— *Middendorffii* Fr. Schm.
— *soyaensis* Kük.
— *fuscidior* Miyabe et Kudo
— *Buxbaumii* Wahlb.
— *Gmelinii* Hook. et Arn.

Species	Region
Scirpus Mertensii Prescott	Provs. Oshima and Shiribeshi.
angustisquama Franch.	Provs. Iburi and Hidaka.
flaviceps Fr. et Sav.	Provs. Ishikari and Teshio.
setis Maxim.	Provs. Tokachi, Kushiro and Nemuro.
oryzaetra Kudo	Prov. Kitami.
nervata Fr. et Sav.	Southern Kuriles.
umbrosa Host.	Northern Kuriles.
blepharicarpa Franch.	Saghalien.
Roylaana Nees	Honshu.
tenuissima Boott	Shikoku and Kyushu.
pisiformis Boott	Korea.
sachalinensis Fr. Schm.	Manchuria, Amur and Ussuri region.
foliosissima Franch.	China.
comira Boott	Himalaya and Tibet.
lasiolepis Franch.	Kamtschatka.
lanceolata Boott	Okhotsk to Ajan.
limosa L.	Siberia.
laxa Wahlb.	Alaska incl. the Aleutian Isls.
sparsiflora Steud.	North America.
siderosticta Hance	Europe.
podogyna Fr. et Sav.	Central Asia.
Sharpnsis Franch.	Western Asia.
cumulatis Fr. et Sav.	Liukiu and Formosa.
stenantha Fr. et Sav.	Indo-China.
capillaris L.	Malay Archipelago.
Brownii Tuck.	India.
ischaostachys Steud.	Africa.
dispalata Boott	Oceania.
	South America.

Species \ Region	Prov. Oshima and Shiribeshi.	Prov. Iburi and Hidaka.	Prov. Ishikari and Teshio.	Prov. Iokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Eriocaulon monococcos Nakai	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sikokianum* Maxim.	+	+	·	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Maquelanum* Koern.	+	+	·	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *kushiroense* Kudo	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Commelina communis L.	·	+	+	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Anelema Keisak Hassk.	·	+	+	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Monochoria Korsakowii Regl. et Maack.	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *vaginalis* Presl.	·	·	·	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·
Luzula Jimboi Miyabe et Kudo	·	·	·	·	·	+	·	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	·
— *japonica* Buch.	·	·	+	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *rufescens* Fisch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *plumosa* E. Mey.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *spadicea* DC.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *campestris* DC.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Juncus bufonius L.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *compressus* Jacq.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *tenuis* Willd.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *filiformis* L.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *beringensis* Buch.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *effusus* L.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *baltieus* Willd.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Fauriensis* Buch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *kamschatcensis* Kudo	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Tokubuchii* Miyabe et Kudo	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *prismatocarpus* R. Br.	·	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *diastrophanthus* Buch.	·	·	+	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *ensifolius* Wikstrom.	·	·	+	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *xiphioides* E. Mey.	+	·	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

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Asparagus lucidus Lindl.	+	·	·	·	·	·	·	·	+	·	+	·	+	·	·	+	·	·	·	·	·	·	+	—	—	—	—	—	—
Clintonia udensis Tracty et Mey.	+	+	+	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	+	—	—	—	—	—	—
Smilacina yezoensis Fr. et Sav.	+	+	·	+	+	+	·	·	+	·	+	+	+	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *japonica* A. Gray	+	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Majanthemum canadense Desf.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	—	—	—	—	—	—
Disporum smilacinum A. Gray	·	·	·	·	·	·	·	·	+	·	+	+	·	·	+	·	+	·	·	·	·	·	·	—	—	—	—	—	—
— *sessile* Don	·	·	·	·	·	·	·	·	+	·	+	+	·	·	+	·	+	·	·	·	·	·	·	—	—	—	—	—	—
Streptopus amplexifolius DC.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	+	·	·	·	—	—	—	—	—	—
— *ajanensis* Tiling	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	—	—	—	—	—	—
Polygonatum involueratum Maxim.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *humile* Fisch.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *officinale* All.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *falcatum* A. Gray	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *multiflorum* All.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *lasianthum* Maxim.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *Kawakamii* Kudo	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Convallaria majalis L.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Paris quadrifolia L.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *tetraphylla* A. Gray	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Trillium kamtschaticum Pall.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *Tschonoskii* Maxim.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *Smallii* Maxim.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Liriope minor Makino	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Ophiopogon japonicus Ker.-Gawl.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Aletris foliata Kudo	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
Smilax China L.	·	·	+	·	·	·	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—
— *herbacea* L.	·	·	·	·	·	·	·	·	+	+	+	·	·	·	·	·	·	·	+	·	·	·	·	—	—	—	—	—	—
Dioscorea Batatas Dcne.	·	·	·	+	·	·	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	—	—	—	—	—	—

— *gracillima* Miq.
— *nipponica* Makino
— *Tokoro* Makino
Iris sibirica L.
— *setosa* Pall.
— *laevigata* Fisch.
— *Kaempferi* Sieb.
Cypripedium guttatum Sw.
— *macranthum* Sw.
— *japonicum* Thunb.
— *rebunense* Kudo
Orchis Beeringiana Kudo
— *cyclochila* Maxim.
Herminium angustifolium Benth. et Hook.
— *Monorchis* R. Br.
Coeloglossum viride Hartm.
Gymnadenia cucullata Rich.
— *Kinoshitai* Makino
— *Tanimae* Miyabe et Kudo
— *conopsea* R. Br.
— *camtschatica* Miyabe et Kudo
Platanthera ussuriensis Maxim.
— *nipponica* Makino
— *tipuloides* Lindl.
— *interrupta* Maxim.
— *minor* Reichb. f.
— *ophrydioides* Fr. Schm.
— *chlorantha* Custor.
— *sachalinensis* Fr. Schm.
— *Takedai* Makino
— *Chorisiana* Reichb. f.
— *japonica* Lindl.
— *hologlottis* Maxim.
— *Makinoi* Yabe
Habenaria sagittifera Reichb. f.
Pogonia japonica Reichb. f.
Arethusa japonica A. Gray
Galeola septentrionalis Reichb. f.
Cephalanthera erecta Lindl.
— *longibracteata* Bl.
Epipactis latifolia All.
— *Thunbergii* A. Gray

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Gastrodia elata Bl.	+	+	+	+	+	·	·	·	+	+	·	·	+	+	·	·	+	·	·	·	·	+	·	·	·	+	·	·	·
Spiranthes australis Lindl.	·	·	·	·	·	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Listera cordata R. Br.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nipponica* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Neottia Nidus-avis Rich.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *navicula* Lindl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Yoshii japonica Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Goodyera Maximowizii Makino.	+	+	+	+	+	·	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pendula* Maxim.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *repens* R. Br.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Myrmechis gracilis Bl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Microstylis monophyllos Lindl.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ephippianthus Schmidtii Reichb. f.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Liparis lilifolia Rich.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* Maxim.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *auriculata* Bl.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Krameri* Fr. et Sav.	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Oreorchis patens Lindl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Calanthe triverianata Lindl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *discolor* Lindl.	+	+	+	+	+	+	·	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nipponica* Makino	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Crenadstra appendiculata Makino	+	+	+	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *unguiculata* Finet	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dactylostalix ringens Reichb. f.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *maculosa* Miyabe et Kudo	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cymbidium virens Lindl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Houttuynia cordata Thunb.	+	+	+	+	+	+	·	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Chloranthus serratus Roem. et Schl.	+	·	·	·	·	+	·	·	+	+	·	·	+	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·

— *japonicus* Sieb.
Populus Maximowiczii A. Henry
— *tremula* L.
Salix cardiophylla Trautv.
— *amygdalina* Levl.
— *hamatidens* Levl.
— *jessoensis* Seem.
— *Reinii* Fr. et Sav.
— *vulpina* Anders.
— *japonica* Thunb.
— *oxdifolia* Trautv.
— *Caprea* L.
— *pauciflora* Koidz.
— *rorida* Lacks.
— *viminalis* L.
— *sachalinensis* Fr. Schm.
— *Buergeriana* Miq.
— *gracilistylis* Miq.
— *lepidostachys* Seem.
— *Miyabeana* Seem.
— *purpurea* L.
Myrica Gale L.
Pterocarya rhoifolia S. et Z.
Juglans Sieboldiana Maxim.
Carpinus cordata Bl.
— *laxiflora* Bl.
Ostrya japonica Sarg.
Corylus heterophylla Fisch.
— *Sieboldiana* Bl.
Betula Maximowicziana Regl.
— *japonica* Sieb.
— *Ermani* Cham.
Alnus japonica S. et Z.
— *hirsuta* Turcz.
— *pendula* Mivsm.
— *Maximowiczii* Call.
Fagus Sieboldi Endl.
Castanea pubinervis C.K. Schn.
Quercus glandulifera Bl.
— *grosseserrata* Bl.
— *mongolica* Fisch.
— *dentata* Thunb.

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Ulmus japonica Sarg.	+	+	·	+	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *laciniata* Mayr	+	+	·	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Celtis Bungeana Bl.	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Morus bombycis Koidz.	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Humulus Lupulus L.	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonicus* S. et Z.	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Urtica angustifolia Fisch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *platyphylla* Wedd.	+	+	·	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *laeteviens* Maxim.	+	+	·	+	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·
Scepocnide macrostachya Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Laportea bulbifera Wedd	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pilea Hamaoi Makino	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *viridissima* Makino	+	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Elatostemma sessile Forst.	+	+	+	+	·	·	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *umbellatum* Bl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Boehmeria biloba Wedd.	+	+	+	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *platanifolia* Fr. et Sav.	+	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *tricuspis* Makino	+	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Thesium refens Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *chinense* Turcz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Viscum album L.	+	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Asarum Sieboldi Miq.	+	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Blumei* Duchartre	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rumex domesticus Hartm.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *crispus* L.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *obtusifolius* L.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *maritimus* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Acetosella* L.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

— *Acetosa* L.	+	+	+	+	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	·	·	·	·	+
Oxyria digyna HILL.	·	·	+	·	+	+	+	·	+	·	·	·	·	+	+	·	+	·	+	+	·	+							
Polygonum aviculare L.	+	+	+	+	+	+	·	+	+	+	+	+	+	+	·	·	+	·	+	+	·	+	·	·	·		+	+	+
— *polyneuron* FR. et SAV.	·	·	·	+	+	·	·	·	+																				
— *amphibium* L.	+	+	·	+	+	+	+	+	+	·	·	+	+	+	·	·	+	·	+	+	·	+	·	·		·	+		
— *viscoferum* MAKINO	+	+	+	·	+	·	·	·	+	+	+																		
— *Hydropiper* L.	+	+	+	+	·	·	·	+	+	+	+	+	+	·	·	·	+	·	+	+	·	+	+	+	+	+	+	+	
— *Maximowiczii* RGL.	+	·	·	·	·	·	·	·	+																				
— *japonicum* MEISN.	+	+	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	+						
— *lapathifolium* L.	·	·	+	·	+	+	·	+	+	·	·	+	+	·	·	·	+	·	+	+	·	·	·	·	·	·	+		
— *nodosum* PERS.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	·	·	+	·	+	+	·	+	+	·	·	+			
— *minus* HUDS.	·	·	+	·	·	·	·	·	+	·	+	+	+	·	·	·	+	·	+	+	·	+	·	·	+	+	·	·	+
— *Blumei* MEISN.	+	+	+	+	+	+	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	+	·	+				
— *Yokusaianum* MAKINO	+	+	+	·	·	+	·	·	+	+	+																		
— *Bistorta* L.	·	·	+	·	+	·	·	+	+	+	+	+	+	·	+	·	+	·	+	+									
— *viviparum* L.	+	+	+	+	+	+	+	+	+	·	+	+	+	+	+	·	+	·	+	+	·	+							
— *virginianum* L.	+	+	+	·	·	·	·	·	+	+	+	+	+	+	·	·	·	·	+	·	·	·	+						
— *alatum* HAMILT.	+	+	+	+	·	·	·	·	+	+	+	+	+	+	·	·	·	·	·	·	·	+	·	·	+	+			
— *Thunbergii* S. et Z.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	·	·	+	·	·	·	·	·	+						
— *hastato-sagittatum* MAKINO	+	+	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	+						
— *sagittatum* L.	+	+	+	+	·	·	·	+	+	+	+	+	+	+	·	·	+	·	+	·	·	·	+	+	·	+			
— *senticosum* FR. et SAV.	+	·	·	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+						
— *perfoliatum* L.	+	+	+	+	+	·	·	·	+	+	+	+	+	+	·	·	·	·	·	·	·	·	+	+	+	+			
— *Weyrichii* FR. SCHM.	+	+	+	+	+	+	·	+	+																				
— *polymorphum* LEDEB.	·	+	+	+	+	+	·	+	+	·	·	·	·	·	+	+	+	·	+	+	·	+							
— *divaricatum* L.	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	+												
— *scandens* L.	+	·	+	+	·	·	·	·	+	·	+	+	+	·	·	·	·	·	+										
— *dumetorum* L.	+	·	+	·	+	·	·	+	+	·	+	+	·	+	·	·	+	·	+	+	·	+							
— *Convolvulus* L.	+	+	+	+	·	·	·	+	+	+	+	+	·	+	+	·	+	·	+	+	·	+							
— *cuspidatum* S. et Z.	+	·	·	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	+						
— *sachalinense* FR. SCHM.	+	+	+	+	+	+	·	+	+																				
Chenopodium album L.	+	+	+	·	+	+	·	+	+	+	+	+	+	+	·	+	+	·	+	+	·	+	+	+	·	+			
— *glaucum* L.	+	+	·	+	+	·	·	+	+	·	+	+	+	+	·	·	+	·	+	+	+	+	·	·	·	·	+	+	+
Atriplex patula L.	+	+	·	+	+	+	+	+	·	·	·	·	·	·	·	·	+	·	+	+	·	+	·	·	·	·	+		
— *littoralis* L.	·	·	·	+	+	·	+	+	+	+	+	+	+	·	·	·	+	·	+	+									
Kochia Scoparia SCHRAD.	+	·	+	·	·	·	·	+	+	+	·	·	+	·	·	·	·	·	+	+	+	·	+	·	·	+			
Salicornia herbacea L.	·	·	·	+	+	·	·	+	·	+	+	+	+	·	·	·	+	·	+	+	·	+	·	·	·	·	+		
Salsola Soda L.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	·	·	·	·	·	+	·	+	·	·	·	·	+		
Amarantus viridis L.	+	+	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	+	+	·	+	·	·	·	+	+	+	+
Achyranthes bidentata BL.	+	+	·	·	·	·	·	·	+	+	+	·		+	·	·	·	·	·	·	·	·	·	·	+				
Phytolacca esculenta VAN HOUTTE	+	+	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	+						
Tetragonia expansa MURR.	+	·	·	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+

Species / Region	Prov. Oshima and Shiribeshi.	Prov. Ishikari and Tesshio.	Prov. Iburi and Hidaka.	Prov. Kitami.	Prov. Yokoshiro, Kushiro and Nemuro.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Montia rivularis Gmel.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Portulaca oleracea L.	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Stellaria radians L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *aquatica* Scop.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nemorum* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *media* Cyrill.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *uliginosa* Murr.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *sachalinensis* Takeda	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *longifolia* Muhl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *ruscifolia* Willd.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *humifusa* Rottb.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *florida* Fisch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Krascheninikovia silvatica Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cerastium Schmidtianum Takeda	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *robustum* Williams	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *ciliatum* Turcz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *boreale* Takeda	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *rigidulum* Takeda	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *caespitosum* Gilib.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sagina saginoides Dalla Torre	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Alsine verna Bartl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *arctica* Fenzl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Arenaria juncea Bieb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *formosa* Fisch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *juncea* Bieb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Kobayashii* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *merckioides* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Moehringia lateriflora Fenzl.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *platysperma* Maxim.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Spergula arvensis L.	·	·	+	+	+	·	·	+	+	·	·	·	·	·	·	·	+	·	+	+									
Spergularia salina PRESL.	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	+	·	+	+	+	+	·	·	·	·	+	+	+
Silene repens PATR.	·	·	·	·	+	+	·	+	·	·	+	+	+	·	+	+	+	·	·	+	·	+							
— *foliosa* MAXIM.	+	+	+	·	·	·	·	·	·	·	+	+																	
— *aprica* TURCZ.	+	+	+	+	·	·	·	·	+	+	+	+	+	·	·	·	+												
Lychnis Wilfordi MAXIM.	·	+	·	·	·	·	·	·	+	·	+	+																	
Cucubalus baccifer L.	+	+	+	+	+	+	·	+	+	+	+	+	+	+	·	·	+	·	·	+	+	+							
Dianthus superbus L.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	·	·	+	·	·	+	·	+	+						
— *nipponicus* MAKINO																													
— *shinanensis* MAKINO	·	·	+	·	·	·	·	·	+																				
Brasenia Schreberi GMEL.	+	+	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	+	·	·	·	·	·	·	+	·	+	
Nymphaea tetragona GEORGI	+	+	+	+	·	+	·	+	+	+	·	+	+	+	+	·	+	·	+	+	·	+							
Nuphar pumilum SM.	·	·	·	+	+	+	·	+	·	·	·	+	·	·	·	·	·	·	·	+									
— *japonicum* DC.	+	+	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+						
Ceratophyllum demersum L.	·	·	·	+	·	·	·	·	+	+	+	+	+	·	·	·	+	·	+	+	·	+	+	·	·	+			
Cercidiphyllum japonicum S. et Z.	+	+	+	+	+	·	·	·	+	+	·	·	+																
Glaucidium palmatum S. et Z.	+	+	+	·	·	·	·	·	+																				
— *paradoxum* MAKINO	+																												
Paeonia obovata MAXIM.	+	+	+	+	·	·	·	+	+	+	+	+	+																
— *japonica* MIYABE et TAKEDA	+	+	+	·	·	·	·	·	+	+																			
Caltha palustris L.	+	+	+	+	+	+	+	+	+	·	+	+	+	+	+	+	+	·	+	+									
Trollius patulus SALISB.	+	+	+	+	+	+	+	+	+	·	+	+	+	·	·	+	+	·	·	·	·	+							
— *Ledebourii* REICHB.	·	·	·	·	+	·	·	+	+	·	+	+	·	·	·	+	+												
Coptis trifolia SALISB.	+	+	+	+	+	+	+	+	+	·	·	+	·	·	+	+	+	+	+	+	·	·	·	·	·	·	·	·	+
— *japonica* MAKINO	+	·	·	·	·	·	·	·	+																				
Actaea spicata L.	+	+	+	+	+	+	·	+	+	+	+	+	+	+	·	+	+	·	+	+									
Cimicifuga yezoensis KUDO	+	+	+	+	+	+	·	+																					
Aquilegia oxysepala TRAUTV. et MEY.	·	+	+	+	+	·	·	·	·	·	+	+	·	·	·	+													
— *flabellata* S. et Z.	+	+	+	+	+	+	+	+	+																				
Aconitum umbrosum KOM.	+	+	+	+	·	·	·	+	+	·	+	+																	
— *yuparense* TAKEDA	·	·	+																										
— *kamtschaticum* WILLD.	·	·	·	·	+	+	+	·	·	·	·	·	·	·	+	·	·	+											
— *kurilense* TAKEDA	·	·	·	·	·	+																							
— *gibbiferum* REICHB.	·	·	·	·	·	+	·	·	·	·	+	·	·	·	+														
— *sachalinense* FR. SCHM.	·	·	·	+	+	·	·	+																					
— *yezoense* NAKAI	+	+	+	+	+																								
— *corymbiferum* NAKAI	+	+	+	+																									
— *lusidusculum* NAKAI	+	·	+	+	+																								
— *subcuneatum* NAKAI	+	+	+	·	·	·	·	·	+																				
Anemone altaica FISCH.	+	+	+	·	·	·	·	·	+	·	+	·	+	·	+	·	+												
— *Raddeana* RGL.	+	·	+	·	·	·	·	·	+	·	+	+	+																
— *gracilis* FR. SCHM.	+	+	+	+	+	+	·	+	+	·	·	+	·	·	+														

Species / Region	Prov. Oshima and Shiribeshi.	Prov. Ishikari and Hidaka.	Prov. Ishikari and Teshio.	Prov. Kitami.	Prov. Toyoura, Kushiro and Nemuro.	Southern Kuriles.	Northern Kuriles.	Sagchalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Anemone flaccida Fr. Schm.	+	·	·	·	+	·	·	·	·	·	·	·	+	·	·	·	+	·	+	+	·	·	·	·	·	·	+	·
— *narcissiflora* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *dichotoma* L.	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
— — *Taraoi* Takeda	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
Clematis fusca Turcz.	·	·	·	·	·	+	+	·	·	·	·	+	+	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·
— *stans* S. et Z.	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *alpina* Mill.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *paniculata* Thunb.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	·	·	·	·	·	·	·
Trautvetteria japonica S. et Z.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ranunculus trichophyllus Chaix	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *reptans* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *Francheti* Boiss.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *sceleratus* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
— — *acris* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
— — *chinensis* Bge.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
— — *Langsdorfii* Spr.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
— — *repens* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	·	+	·	·	·	·	·	·
Thalictrum aquilegifolium L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *integrifolium* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *tuberiferum* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *baicalense* Turcz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sachalinense* Lecoy.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *affine* Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *foetidum* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *minus* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *Faurei* Levl. et Vnt.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *kamikavense* Levl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *kamiense* Franch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

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Cardamine impatiens L.	+	+	+	+	+	·	+	+	+	·	·	+	+	·	·	+	·	+	+	·	+	+	·	·	·	·	·
— *Regeliana* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *procumbens* Fisch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *tenuifolia* Boiss.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *nipponica* Fr. et Sav.	·	+	·	+	+	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Capsella Bursa-pastoris Medik.	·	+	·	+	·	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Draba nemorosa L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sachalinensis* Fr. Schm.	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *borealis* DC.	·	·	·	·	+	·	+	·	·	·	+	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·
Stenophragma Thalianum Celak.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Arabis flagellosa Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *lyrata* L.	·	·	·	·	·	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Halleri* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *senanensis* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *glabra* Bernh.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pendula* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *nipponica* Boiss.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* A. Gray	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pseudo-auriculata* Boiss.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *glauca* Boiss.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Boissieuana* Nakai	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Macropodium pterospermum Fr. Schm.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Erysimum cheiranthoides L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Drosera rotundifolia L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *anglica* Huds.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sedum roseum Scop.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Sieboldi* Sweet	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

— *verticillatum* L.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	+								
— *Ishidae* Miyabe et Kudo	·	·	+																				
— *albo-roseum* Bak.	+	·	·	·	·	·	·	·	+	·	·	+	+										
— *Telephium* L.	·	·	·	+	+	+	·	+	+	+	+	+	+	·	+	·	+	·	·	+			
— *Aizoon* L.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+						
— *kamtschaticum* Fisch.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	+	·	+						
Cotyledon malacophylla Pall.	+	+	+	+	+	·	·	+	+	·	+	+	+	·	·	·	+						
— *japonica* Maxim.	+	·	·	·	·	·	·	·	+	+	+	+											
— *minuta* Kom.	·	·	+	·	·	·	·	·	·	·	+	+											
Tillaea aquatica L.	·	+	+	+	·	+	·	·	+	·	+	·	·	·	·	·	+	·	+	+			
Astilbe Thunbergii Miq.	+	+	+	·	·	+	·	·	+	+	+	·	+										
— *platyphylla* Boiss.	+	+	·	+																			
Rodgersia podophylla A. Gray	+	·	·	·	·	·	·	·	+	·	+	+	+										
Boykinia lycoctonifolia Engl.	·	+	+	·	+	·	·	·	+														
Saxifraga yezoensis Engl.	+	·	+	+	+	+	·	+															
— *rivularis* L.	·	·	·	·	·	+	+	·	·	·	·	·	·	·	+	·	+	+	+	+			
— *laciniata* Nakai et Takeda	·	·	+																				
— *japonica* Boiss.	+	·	+	+	·	·	·	·	+	+													
— *punctata* L.	·	·	+	·	+	·	+	+	·	·	·	+	·	·	+	+	+	+	+				
— *fusca* Maxim.	+	+	+	+	+	+	+	·	+														
— *Fauriei* Boiss.	·	·	·	+																			
— *cortusaefolia* S. et Z.	+	+	+	+	+	+	·	·	+	+	+	+	+	+									
— *madida* Makino	·	·	·	·	+	·	·	·	+	+													
— *Nishidae* Miyabe et Kudo	·	·	+																				
— *Merkii* Fisch.	·	·	+	·	·	+	+	·	·	·	·	·	·	·	+	·	+						
— *bronchialis* L.	+	·	+	·	+	+	·	+	+	·	·	·	·	·	+	+	+	+	+				
Tiarella polyphylla Don	+	+	+	+	+	·	·	·	+	+	·	·	+	+									
Mitella integripetala Boiss.	+	+																					
Chrysosplenium alternifolium L.	+	+	·	·	·	·	·	+	+	·	·	+	+	·	+	+	+	·	+	+	·	+	
— *flagelliferum* Fr. Schm.	+	+	+	+	+	·	+	+	+	+	·	+	+										
— *costulatum* Franch.	+	+	·	·	·	·	·	·	+														
— *crenulatum* Franch	+	·	+	+	·	·	·	·	+														
— *ramosum* Maxim.	+	·	+	·	·	·	·	·	+	·	·	+	·	·	·	+							
— *kamtschaticum* Fisch.	+	+	+	+	+	+	+	+	+	·	·	·	·	·	+								
— *Grayanum* Maxim.	+	+	+	+	·	·	·	·	+														
Parnassia palustris L.	+	+	+	+	+	+	+	+	+	+	+	·	·	+	·	·	+	+	+	+	·	+	+
Deutzia crenata S. et Z.	+	·	·	·	·	·	·	·	+	+													
Hydrangea paniculata Sieb	+	+	+	+	+	+	·	+	+	+	·	·	+										
— *acuminata* S. et Z.	+	+	+	+	·	·	·	·	+	+	+	·	+										
— *petiolaris* S. et Z.	+	+	+	+	+	+	·	+	+	+	+												
Schizophragma hydrangeoides S. et Z.	+	+	+	·	+	·	·	·	+	+	+												
Ribes triste Pall.	·	·	·	+	+	·	·	+	·	·	·	+	·	·	·	·	+	·	+				

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Ribes latifolium Jancz.	+	+	+	+	+	+	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sachalinense* Nakai	+	+	+	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *japonicum* Maxim.	+	+	+	·	+	·	·	+	+	+	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·
Hamamelis japonica S. et Z.	·	·	·	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Spiraea salicifolia L.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+	·	+	+	·	·	·	·	·	·	·	·
— *Fauriana* C.K. Schn.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *ulmifolia* Scop.	+	+	+	+	+	+	·	+	+	+	+	+	+	·	+	·	+	·	+	+	+	·	·	·	·	·	·	·
— — *media* Schmidt	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+	·	+	+	+	·	·	·	·	·	·	·
— — *betulaefolia* Pall.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+	·	+	+	+	·	·	·	·	·	·	·
— — *Miyabei* Koidz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* L. f.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Aruncus sylvester Kostel.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sorbaria sorbifolia A. Br.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sorbus Matsumurae Koehne	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sambucifolia* Roem.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *commixta* Hedl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Micromeles alnifolia Koehne	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Malus Sieboldii Rehder	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *baccata* Borkh.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+	·	+	+	·	·	·	·	·	·	·	·
— — *yezoensis* Koidz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Photinia villosa DC.	+	+	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Crataegus jozana C.K. Schn.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *chlorosarca* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sanguinea* Pall.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rubus Chamaemorus L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pedatus* Sm.	+	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *arcticus* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pseudo-japonicus* Koidz.	+	+	+	+	+	+	·	+	+	·	+	+	+	·	+	·	+	·	+	+	·	·	·	·	·	·	·	·

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Prunus Maximowiczii Rupr.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
— *serrulata* Lindl.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
— *Lannesiana* Wils.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
— *kurilensis* Miyabe	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
— *Grayana* Maxim.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
— *Padus* L.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
— *Ssiori* Fr. Schm.	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+
Cassia mimosoides L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Maackia amurensis Rupr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Thermopsis fabacea DC.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Trifolium Lupinaster L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Lotus corniculatus L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Astragalus membranaceus Bge.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *secundus* DC.	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *kurilensis* Matsum.	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *reflexistipulus* Miq.	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Kawakamii* Matsum.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonicus* Bois.	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Oxytropis Pumilio Ledeb.	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *rishiriensis* Matsum.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *megalantha* Bois.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *rebsa* Matsum.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Hedysarum obscurum L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *esculentum* Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Desmodium japonicum M.-Q.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Lespedeza bicolor Turcz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Buergeri* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *juncea* Pers.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

— *striata* Hook. et Arn.	+	+	+	·	·	·	·	·	+	+	·	+	+	·	·	·	·	·	+	·	·	·	+						
Vicia amaena Fisch.	+	+	+	+	·	·	·	+	+	·	+	+	+	·	·	·	+												
— *japonica* A. Gray	+	+	+	+	+	+	·	+	+	·	+	+	+	·	·	·	+												
— *Cracca* L.	+	+	+	+	+	+	·	+	+	·	+	·	+	·	+	·	+	·	+	+	·	+	·	·	·	·	+		
— *Pseudo-Orobus* Fisch. et Mey.	·	+	·	·	·	·	·	·	+	+	+	+	+	·	·	·	+												
— *sativa* L.	·	·	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	+	·	·	+						
— *sepium* L.	·	·	+	·	+	·	·	·	+	·	·	·	·	·	·	·	+	·	+	+	·	+							
— *Fauriae* Franch.	+	·	·	·	·	·	·	·	+																				
— *nipponica* Matsum.	·	+	·	·	·	·	·	·	+	+	+																		
— *unijuga* A. Br.	+	+	+	+	+	+	+	·	+	+	+	+	+	·	·	·	+												
Lathyrus maritimus Bigel.	+	+	+	+	+	+	+	+	+	+	+	+	·	·	+	·	+	·	+	+									
— *Davidii* Hance	·	+	+	·	·	·	·	·	+	·	+	+	+																
— *palustris* L.	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	·	+												
Glycine ussuriensis Rgl.	+	·	·	·	·	·	·	·	+	+	+	+	+																
Falcata japonica Kom.	+	+	+	+	·	·	·	·	+	+	·	+	+																
Apios Fortunei Maxim.	+	·	·	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	+						
Pueraria Thunbergiana Benth.	+	+	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+						
Geranium eriostemon Fisch.	·	·	+	+	·	·	·	·	+	·	+	+	+	·	·	·	+												
— *erianthum* DC.	+	+	+	+	+	+	+	+	+	·	·	+	·	·	+	+	+	·	+										
— *yezoense* Fr. et Sav.	+	+	·	+	+	+	+																						
— *Krameri* Fr. et Sav.	+	+	+	+	·	·	·	·	+	·	·	+	+																
— *nepalense* Sweet	+	+	+	·	+	·	·	·	+	+		+	+	+															
— *sibiricum* L.	+	+	+	+	+	+	·	+	·	·	+	+	+	·	·	·	+	·	+	+	·	+							
Oxalis Acetosella L.	+	+	+	+	+	+	·	+	+	+	+	+	+	+	·	·	·	·	+	+	·	·	·	·	·	+	+		
— *corniculata* L.	+	+	+	·	·	·	·	·	+	+	+	+	+	+	·	·	+	·	+	+	·	+	+	·	·	+	·	·	+
— *stricta* L.	+	+	+	·	·	·	·	·	·	·	+	+	+	·	·	·	·	·	+	+									
Linum stelleroides Planch.	+	·	·	·	·	·	·	·	+	·	+	+	+																
Xanthoxylum piperitum DC.	+	+	+	·	·	·	·	·	+	+	+	+	+																
Phellodendron amurense Rupr.	+	+	+	+	+	+	·	+	+	+	+	+	+																
Skimmia japonica Thunb.	+	+	+	+	+	+	+	+	+	+	·	·	+	+	·	·	·		·	·	·	·	+	·	+				
Picrasma quassioides Benn.	+	+	+	·	·	·	·	·	+	+	+	·	+	+	·	·	·	·	·	·	·	·	+						
Polygala japonica Houtt.	+	+	+	+	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+						
Daphniphyllum humile Maxim.	+	+	+	·	+	+	·	·	+																				
Acalypha australis L.	+	·	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	+						
Euphorbia adenochloa Morr. et Dcne.	+	+	·	·	·	·	·	·	+																				
— *ebracteolata* Hayata	+	+	+	·	·	·	·	·	+																				
— *Sieboldiana* Morr. et Dcne.	+	+	+	·	·	+	·	·	+	·	+	+																	
— *maculata* L.	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+										
Callitriche verna L.	+	+	+	+	·	·	·	+	·	·	+	+	+	+	+	·	+	·	+	+	·	·	·	·	·	·	·	+	+
— *stagnalis* L.	·	·	+	·	·	·	·	·	+	+	·	·	·	+	·	·	·	·	·	+	·	·	·	·	+	+	+	+	
Pachysandra terminalis S. et Z.	+	+	+	+	+	·	·	·	+	·	·	·	+																
Empetrum nigrum L.	+	+	+	+	+	+	+	+	+	·	+	+	·	·	+	·	+	·	+	+	·	+	·	·	·	·	·	·	+

Species / Region	Prov. Oshima and Shiribeshi.	Prov. Ishikari and Hidaka.	Prov. Iburi and Hidaka.	Provs. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Coriaria japonica A. Gray.	+	+	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rhus trichocarpa Miq.	+	+	+	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *javanica* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
— *ambigua* Lavallée	·	·	·	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ilex crenata Thunb.	+	+	+	+	+	+	+	·	+	+	·	·	+	+	·	·	·	·	·	·	·	·	+	·	·	·	·	·
— *Sugeroki* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *integra* Thunb.	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
— *rugosa* Fr. Schm.	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *macropoda* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Celastrus articulatus Thunb.	·	·	·	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
Evonymus alata Sieb.	·	·	·	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Vidalii* Fr. et Sav.	·	·	·	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *oxyphylla* Miq.	·	·	·	·	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *macroptera* Rupr.	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sachalinensis* Maxim.	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* Thunb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Staphylea Bumalda DC.	+	+	+	+	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Francheti* Bois.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Acer ukurunduense Trautv. et Mey.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Ginnala* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonicum* Thunb.	+	+	+	+	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *palmatum* Thunb.	+	+	+	+	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *cissifolium* Koch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *pictum* Thunb.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Mayri* Schwerin	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Miyabei* Maxim.	+	+	+	+	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Tschonoskii* Maxim.	+	+	+	+	·	·	·	·	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Aesculus turbinata Bl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

Species \ Region	Prov. Oshima and Shiribeshi.	Prov. Ishikari and Hidaka.	Prov. Iburi and Tesshio.	Prov. Yokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kurile.	Northern Kurile.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Hypericum collina Bessek.	+	+	+	+	·	+	+	·	·	·	·	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·
— *nipponica* Maxim.	+	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *rostrata* Muhl.	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *obtusa* Makino	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *grypoceras* A. Gray	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Grayi* Fr. et Sav.	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *silvestriformis* W. Bckr.	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *mirabilis* L.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sachalinensis* H. de Boiss.	·	·	·	·	·	+	·	·	+	·	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·
— *Langsdorfii* Fisch.	·	·	·	·	·	+	+	+	+	·	·	·	·	·	+	·	+	+	·	·	·	·	·	·	·	·	·	·
— *Kusanoana* Makino	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *crassa* Makino	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *biflora* L.	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *micrantha* Turcz.	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *Raddeana* Rgl.	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *verecunda* A. Gray	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *semi-lunaris* W. Bckr.	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *hidakana* Nakai	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
— *brevistipulata* W. Bckr.	·	·	·	·	·	+	+	+	+	·	+	·	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·
Stachyurus praecox S. et Z.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Daphne jezoensis Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Miyabeana* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Elaeagnus multiflora Thunb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *umbellata* Thunb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rotala indica Koehne	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Lythrum Salicaria L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Alangium platanifolium Harms	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Epilobium angustifolium L.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

Species \ Region	Prov. Oshima and Shiribeshi.	Prov. Ishikari and Teshio.	Prov. Iburi and Hidaka.	Prov. Nemuro, Tokachi, Kushiro and	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Sagchalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Hydrocotyle ramiflora Maxim.	+	+	+	·	·	·	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sanicula elata Hamilt.	+	+	+	+	+	+	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Anthriscus sylvestris Hoffm.	+	+	+	+	+	+	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Osmorhiza aristata Makino et Yabe	+	+	+	+	+	+	·	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *amurensis* Fr. Schm.	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Torilis Anthriscus Bernh.	·	·	·	·	·	+	+	+	+	+	+	+	+	+	·	·	+	·	·	+	·	·	·	·	·	·	·	·
Pleurospermum austriacum Hoffm.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Bupleurum longifolium L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *longiradiatum* Turcz.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *triradiatum* Adams	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cicuta virosa L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cryptotaenia japonica Hassk.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Carum holopetalum Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pimpinella caljcina Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Aegopodium alpestre Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sium Ninsi L.	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *cicutaefolium* Gmel.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Chamaele decumbens Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Seseli Libanotis Koch	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Oenanthe stoloniifera DC.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cnidium ajanense Drude	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonicum* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Tachirovei* Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ligusticum scoticum L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonicum* Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sesayamense* Kudo	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Coelopleurum Gmelini Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Conioselinum kamtschaticum Rupr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

Species / Region	Provs. Oshima and Shiribeshi.	Provs. Ishikari and Teshio.	Provs. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Phyllodoce coerulea Bab.	+	+	+	+	+	·	+	·	·	+	·	·	·	+	·	·	·	+	+									
— *aleutica* Makino	+	+	+	+	+	·	+	·	·	+	·	·	·	+	·	·	·	+										
Bryanthes Gmelinii Don	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·										
Rhodianthus campanulatus Nichols.	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·										
Cassiope lycopodioides Don	+	+	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·										
— *Stelleriana* DC.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
Leucothoe Grayana Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
Andromeda polifolia L.	+	+	+	+	+	+	+	·	·	·	·	+	·	+	+	+	·	+	+									
Arcteria nana Makino	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
Chamaedaphne calyculata Reichb.	+	+	+	+	+	+	+	·	·	·	+	+	·	·	+	·	+	+										
Epigaea asiatica Maxim.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·										
Gaultheria adenothrix Maxim.	+	+	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·										
— *Miqueliana* Takeda	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
Arctous alpina Niedz.	+	+	+	+	+	+	+	·	·	·	·	+	·	+	+	+	·	+	+									
Oxycoccus palustris Pers.	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
— *japonicus* Makino	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
Vaccinium Vitis-idaea L.	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
— *uliginosum* L.	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
— *ovalifolium* Sm.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
— *Smallii* A. Gray	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
— *Buergeri* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
— *praestans* Lamb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
— *ciliatum* Thunb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
Diapensia lapponica L.	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	+	+									
Shortia soldanelloides Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										
Ardisia japonica Bl.	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
Primula Sieboldii E. Morren	+	+	+	+	+	+	+	·	·	·	·	·	·	+	·	·	·	·										
— *jezoana* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·										

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Fauria Crista-galli Makino	·	+	+	·	·	+	·	·	+	·	·	+	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·
Menyanthes trifoliata L.	·	+	+	·	+	+	·	+	+	·	·	+	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·
Amsonia elliptica Roem. et Sch.	·	+	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Apocynum venetum L.	·	+	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cynostelma chinensis Bge.	·	+	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Metaplexis japonica Makino	·	+	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cynanchum atratum Bge.	·	+	+	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *inamoenum* Loesn.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *caudatum* Maxim.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *volubile* Hemsl.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Calystegia Soldanella R. Br.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sepium* R. Br.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cuscuta europaea L.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Epilinum* Weihe	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* Choisy	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Polemonium coeruleum L.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Tournefortia sibirica L.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Omphalodes Krameri Fr. et Sav.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cynoglossum asperrimum Nakai	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Erigrichum nipponicum Makino	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Bothriospermum tenellum Fisch. et Mey.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Myosotis intermedia Link.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Mertensia maritima G. Don	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *riualaris* DC.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Trigonotis peduncularis Benth.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Gaudichaudii* Maxim.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Lithospermum officinale L.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Zollingeri* DC.	·	+	+	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

Callicarpa japonica Thunb.
Clerodendron trichotomum Thunb.
Caryopteris divaricata Maxim.
Ajuga yezoensis Maxim.
— ciliata Bge.
Teucrium vernicoides Maxim.
— teinense Kudo
— japonicum Willd.
— Miquelianum Kudo
Scutellaria ussuriensis Kudo
— dependens Maxim.
— yezoensis Kudo
— Schmidtii Kudo
Agastache rugosa O.K.
Nepeta subsessilis Maxim.
Glechoma hederacea L.
Dracocephalum japonicum Kudo
Prunella vulgaris L.
Chelonopsis moschata Mq.
Galeopsis Tetrahit L.
Lamium amplexicaule L.
— album L.
Leonurus macranthus Maxim.
— sibiricus L.
Stachys japonica Miq.
Satureia sachalinensis Kudo
— ussuriensis Kudo
— chinensis Bge.
Thymus serpyllum L.
Lycopus parviflorus Maxim.
— Maackianus Kom.
— lucidus Turcz.
— japonicus Matsum. et Kudo
Mentha sachalinensis Kudo
Mosla japonica Maxim.
— grosseserrata Maxim.
Elsholtzia Patrini Garcke
Comanthosphace stellipila S. Moore
Plectranthus trichocarpus Maxim.
— glaucocalyx Maxim.
— inflexus Vahl.
Lycium chinense Mill.

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Physaliastrum echinatum Makino	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Solanum Dulcamara L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *macrocarpum* Kudo	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *nigrum* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Datura alba Nees	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Linaria japonica Miq.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Scrophularia Grayana Maxim.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pedicularis frondosa Lamb.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mimulus sessilifolius Maxim.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *nepalensis* Bentil.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mazus japonicus Ok.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *stolonifer* Makino	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Limosella aquatica L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lindernia pyxidaria All.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Veronica stricta L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Tournefortii* Gmel.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *polita* Fries	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Grayi* Miyabe et Kudo	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *longifolia* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *serpyllifolia* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Stelleri* Pall.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Schmidtiana* Regl.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *senanensis* Maxim.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *arvensis* L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *Thunbergii* A. Gray	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *americana* Schwerin	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lagotis glauca Gaertn.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Melampyrum laxum Miq.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Species / Region	Provs. Oshima and Shiribeshi.	Provs. Ishikari and Teshio.	Provs. Ishikari and Hidaka.	Provs. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Linkin and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Rubia cordifolia L.	+	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	+	·	·	·
— *chinensis* Regl.	·	+	+	·	·	·	·	·	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *jesoensis* Miyabe et Miyake	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Sambucus chinensis Lindl.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *latipinna* Nakai	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Viburnum pubinerve Bl.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·
— *Wrightii* Miq.	+	+	+	+	+	+	+	+	+	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *dilatatum* Thunb.	+	+	+	+	+	+	+	+	+	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *furcatum* Bl.	·	·	·	·	·	·	·	·	+	+	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Linnaea borealis L.	·	·	·	·	·	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	·	·	·	·	·	·	·	·
Lonicera gracilipes Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *coerulea* L.	·	·	·	·	·	+	+	+	+	+	+	+	+	+	+	·	+	·	+	+	+	·	·	·	·	·	·	·	·
— — *strophophora* Franch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— — *Glehni* Fr. Schm.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Chamissoi* Bge.	+	+	+	+	+	+	+	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *chrysantha* Turcz.	+	+	+	+	+	+	+	+	+	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Morrowii* A. Gray	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Diervilla Middendorffiana Carr.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·
— *coraeensis* DC.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·
— — *japonica* DC.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·
Adoxa moschatellina L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Patrinia gibbosa Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sibirica* Juss.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *villosa* Juss.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·
— — *scabiosaefolia* Fisch.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Valeriana officinalis L.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	·	+	+	+	+	·	·	·	·	·	·	·
Scabiosa japonica Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Actinostemma lobatum Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·

Schizopepon bryoniaefolius Maxim.
Trichosanthes japonica Regl.
Gynostemma pedatum Bl.
Campanula dasyantha Bge.
— punctata Lam.
— tasiocarpa Cham.
Adenophora Thunbergiana Kudo
— latifolia Fisch.
— motiwana Nakai
— yaparensis Kudo
Terracarpa circaeoides H. Fedr.
Cotonopsis lanceolata Benth. et Hook.
— ussuriensis Hemsl.
Platycodon grandiflorum A. DC.
Lobelia sessilifolia Lamb.
Eupatorium japonicum Thunb.
— serrhalinense Makino
— Lindleyanum DC.
Solidago Virgaurea L.
Asteromoea indica Bl.
Aster trinervis Roxb.
— Glehni Fr. Schm.
— scaber Thunb.
— tataricus L. f.
— rugulosus Maxim.
— Tripolium L.
Erigeron Thunbergii A. Gray
— acre L.
— kamtschaticum DC.
— canadense L.
Antennaria dioica Gaertn.
Leontopodium discolor Beatv.
Anaphalis alpicola Makino
— margaritacea Benth. et Hook.
Gnaphalium uliginosum L.
— multiceps Wall.
— hypoleucum DC.
— japonicum Thunb.
Inula salicina L.
— britannica L.
Carpesium triste Maxim.
— glossophyllum Maxim.

Species \ Region	Prov. Oshima and Shiribeshi.	Prov. Iburi and Hidaka.	Prov. Ishikari and Teshio.	Prov. Yokoshi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Turkin and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Carpesium cernuum L.	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
— *abrotanoides* L.	·	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Adenocaulon adhaerescens Maxim.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Xanthium Strumarium L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Siegesbeckia pubescens Makino	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Bidens radiata Thuill.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *tripartita* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *cernua* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Achillea Millefolium L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sibirica* Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Ptarmica* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Matricaria matricarioides Port.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *ambigua* Miyabe	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Chrysanthemum arcticum L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Weyrichii* Miyabe et Miyake	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Tanacetum vulgare L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Centipeda minima OK.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Artemisia clesertorum Spr.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *japonica* Thunb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Keiskeana* Miq.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *vulgaris* L.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *sacrorum* Ledeb.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *laciniata* Willd.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *norvegica* Fries	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *Stelleriana* Bess.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
— *serrata Weber*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Tetasites japonicus M.Q.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Arnica unalaskensis Less.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·

Species / Region	Provs. Oshima and Shiribeshi.	Provs. Iburi and Hidaka.	Provs. Ishikari and Teshio.	Provs. Tokachi, Kushiro and Nemuro.	Prov. Kitami.	Southern Kuriles.	Northern Kuriles.	Saghalien.	Honshu.	Shikoku and Kyushu.	Korea.	Manchuria, Amur and Ussuri region.	China.	Himalaya and Tibet.	Kamtschatka.	Okhotsk to Ajan.	Siberia.	Alaska incl. the Aleutian Isls.	North America.	Europe.	Central Asia.	Western Asia.	Liukiu and Formosa.	Indo-China.	Malay Archipelago.	India.	Africa.	Oceania.	South America.
Picris crepioides Miyabe et Kudo	·	+																											
Crepis japonica Benth.	+	+	+	·	+	·	·	·	+	+	·	·	+	·	·	·	·	·	·	·	·	+	+	·	+	+	+	+	
— *gymnopus* Koidz.	·	·	+																										
— *burejensis* Fr. Schm.	·	·	+	·	+	+	·	+	·	·	·	+																	
Hieracium umbellatum L.	+	+	+	+	+	+	·	+	+	·	+	+	+	+	+	·	+	·	+	+	·	·	·	·	·	·	+		
Taraxacum platycarpum Dahlst.	+	+	+	·	+	+	·	·	+	+																			
— *ceratophorum* DC.	·	·	+	·	·	·	+	+	·	·	·	·	·	·	+	+	+	+	·	+									
Lactuca Raddeana Maxim.	+	+	+	+	+	+	·	·	+	+	+	+					+												
— *laciniata* Makino	+	+	+	+	·	·	·	·	+	+	+	+	+	+	·	·		·	·	·	·	·	+	·	+				
— *sibirica* Benth.	·	·	+	+	+	·	+	+	·	·	·	+	+	·	+	+	·	·	+	+									
— *denticulata* Maxim.	+	+	+	·	·	·	·	·	+	+	+	+	+				+												
— *dentata* Makino	+	+	+	+	+	·	·	·	+	+	·	·	+	·	·	·		·	·	·	·	·	+	·	+				
— *repens* Benth. et Hook.	+	+	+	+	+	+	+	+	+	+	+	+	+	·	+	·	·	·	·	·	·	·	+						
— *stolonifera* Benth. et Hook.	+	+	+	+	·	·	·	·	+	+	+	·	+				·												
— *debilis* Benth. et Hook.	+	·	·	·	·	·	·	·	+	+	+	·	+	·	·	·		·	·	·	·	·	+	·	+				
Sonchus oleraceus L.	+	·	+	·	·	+	·	+	+	+	+	+	+	+	·	·	·	·	+	+	·	+	+	·	·	+	·	+	
— *asper* Hill.	+	·	+	+	·	·	·	+	+	·	·	·	+	+	·	·	+	·	+	+	·	+	·	·	·	+			
— *arvensis* L.	+	+	+	+	+	+	·	+	+	+	+	+	+	+	·	·	+	·	+	+	·	+	+	·	·	+			
Scorzonera radiata Fisch.	·	·	·	·	+	·	·	+	·	·	·	+	+	·	·	+	+												
Total 1629	1141	1015	1166	829	703	615	291	625	1298	654	737	711	643	221	307	160	523	122	435	454	22	244	258	38	71	142	118	97	57

11. Floristic composition of the vegetation of Yezo.

The floristic composition of the vegetation of Yezo can readily be ascertained from the foregoing list. The vegetation of Yezo, including the Southern Kuriles, is made up of 132 families divided into 597 genera and 1629 species. Of these families, eight belong to Pteridophytes, and among the Spermatophytes are the two Gymnosperm families of Taxaceae and Pinaceae, leaving 122 families of Angiosperms. None of these families are peculiar to the region under review.

The eight families of Pteridophytes include 30 genera with 98 species. Polypodiaceae has within our limits 21 genera and 65 species, *Dryopteris* being the largest genus with 19 species, followed by *Athyrium* with 11 species, *Polystichum* with 7, and *Polypodium* with 6. Hymenophyllaceae and Ophioglossaceae each have two genera, the largest genus *Botrychium*, belonging to the latter, having 5 species. The remaining families have each a single genus, of which *Lycopodium* has 10 species and *Equisetum* 6.

Taxaceae has two genera with a single species each. Pinaceae in its 6 genera includes 11 species.

Of the 122 families of Angiosperms, the family with the largest number of species is Cyperaceae, the 11 genera of which are divided into 142 species, the vast majority being in *Carex*, the largest genus of Yezo; this family also shows the largest average ratio of species per genus, namely 12.9. Next comes Gramineae with 49 genera (more than any other family) and 117 species. Third in number of species, and second in number of genera, is Compositae: this great family of world-wide distribution has within our limits 39 genera and 116 species. Liliaceae has 29 genera divided into 64 species. Rosaceae in its 21 genera includes 73 species. Orchidaceae is composed of 27 genera with 61 species. Ranunculaceae with 15 genera contains 55 species. These 7 families—Cyperaceae, Gramineae, Compositae, Rosaceae, Liliaceae, Orchidaceae and Ranunculaceae—comprise between them 191 genera and 628 species or 32.0 per cent of the genera and 41.1 per cent of the species of all the Angiosperms in the list.

The remaining 58.9 per cent of the Angiosperms is made up of the other 115 families, of which :—

10 families have more than 30 species :

Cruciferae	14 genera,	44 species.
Umbelliferae	24 genera,	39 species.
Labiatae	21 genera,	38 species.

Ericaceae	18 genera,	38 species.
Leguminosae	16 genera,	38 species.
Caryophyllaceae	14 genera,	36 species.
Polygonaceae	3 genera,	36 species.
Scrophulariaceae	14 genera,	35 species.
Saxifragaceae	12 genera,	35 species.
Violaceae	1 genus,	32 species.

5 families have 20 to 29 species inclusive :

Oenotheraceae	3 genera,	26 species.
Juncaceae	2 genera,	25 species.
Gentianaceae	6 genera,	20 species.
Potamogetonaceae	3 genera,	20 species.
Salicaceae	2 genera,	20 speices.

11 families have from 10 to 19 species inclusive :

Rubiaceae	5 genera,	19 species.
Primulaceae	8 genera,	18 species.
Caprifoliaceae	5 genera,	17 species.
Guttiferae	1 genus,	13 species.
Borraginaceae	9 genera,	12 species.
Campanulaceae	6 genera,	12 species.
Urticaceae	6 genera,	12 species.
Betulaceae	5 genera,	12 species.
Crassulaceae	3 genera,	12 species.
Pirolaceae	4 genera,	11 species.
Araliaceae	8 genera,	11 species.

19 families have from 5 to 9 species inclusive :

Araceae	6 genera,	9 species.
Aceraceae	1 genus,	9 species.
Papaveraceae	4 genera,	8 species.
Chenopodiaceae	5 genera,	7 species.
Celastraceae	2 genera,	7 species.
Vitaceae	4 genera,	6 species.
Solanaceae	4 genera,	6 species.
Fagaceae	3 genera,	6 species.
Euphorbiaceae	3 genera,	6 species.
Asclepiadaceae	3 genera,	6 species.
Geraniaceae	1 genus,	6 species.
Sparganiaceae	1 genus,	6 species.
Berberidaceae	5 genera,	5 species.

Cornaceae	3 genera,	5 species.
Oleaceae	3 genera,	5 species.
Lentibulariaceae	2 genera,	5 species.
Convolvulaceae	2 genera,	5 species.
Valerianaceae	2 genera,	5 species.
Aquifoliaceae	1 genus,	5 species.

The remaining 70 families have 4 or fewer species, namely :

9 families with 4 species,
12 families with 3 species,
21 families with 2 species,
28 families with 1 species.

The following is a classification of the Angiosperm genera in the order of number of species :

With 107 species—*Carex*.
With 32 species—*Viola*.
With 29 species—*Polygonum*.
With 20 species—*Epilobium*.
With 19 species—*Juncus*.
With 18 species—*Salix*.
With 17 species—*Potamogeton*.
With 13 species each—*Platanthera, Potentilla, Hypericum, Galium*.
With 12 species each—*Poa, Saxifraga, Veronica*.
With 11 species each—*Thalictrum, Arabis, Gentiana, Cirsium*.
With 10 species each—*Stellaria, Aconitum, Cardamine, Rubus*.
With 9 species each—*Calamagrostis, Scirpus, Vicia, Acer, Artemisia, Saussurea*.
With 8 species each—*Sedum, Ranunculus, Rhododendron, Senecio, Lactuca*.
With 7 species each—*Allium, Polygonatum, Anemone, Chrysosplenium, Spiraea, Prunus, Vaccinium, Primula, Pedicularis, Lonicera*.
With 6 species each—*Sparganium, Festuca, Bromus, Eleocharis, Luzula, Lilium, Rumex, Cerastium, Nasturtium, Astragalus, Geranium, Evonymus, Pyrola, Aster*.
With 5 species each—*Glyceria, Sasa, Gymnadenia, Corydalis, Rosa, Ilex, Circaea, Angelica, Lysimachia, Cacalia*.

12. Botanical Districts of Yezo.

The vegetation of Yezo varies somewhat according to district, and a few striking contrasts may be noted, *e.g.* between the Birch forests of

the west and the Spruce (*Picea Glehni*) forests of the east. Climate is undoutedly one of the principal factors upon which the variation depends. As stated in my paper on the Labiates of Hokkaido,[1] the island of Yezo, from the phytogeographical point of view, can conveniently be divided into five districts, each of course merging into the next without any sharply defined boundary.

The first district is the south-western corner of Yezo, comprising the two provinces Oshima and Shiribeshi, with an area of about 3536.7 square miles. The number of species growing wild in this district is 1141, amounting to 70.04 % of the total number of Yezo species, or 0.322 species per square mile. Among the more noticeable features of the vegetation are the great scarcity of bogs and of Fir and Spruce forests, and the predominance of the Birch forest. This is partly due to the warmer climate induced by the warm current which washes the coast. From a dendrological standpoint, this district is the only one in which the plantation of *Cryptomeria japonica* is possible, and this tree has in fact been extensively and successfully introduced, not merely in recent years for re-afforestation purposes but ever since the earliest years of Japanese occupation.

Generally speaking, the vegetation of this district conforms closely to that of Northern Honshu. For example, *Thujopsis dolabrata* var. *Hondai*, which forms a magnificent and almost pure forest in Mutsu, the most northerly province of Honshu, is found growing in the same manner in the Hokkaido province of Oshima, and *Pterocarya rhoifolia* of Honshu likewise extends to Oshima though not beyond. *Fagus Sieboldi* reaches its northern limit near Kuromatsunai in Shiribeshi Province. Other characteristic, if less abundant, shrubs which are confined to this district in their distribution in Yezo are *Ilex integra* var. *leucoclada*, *Stachyurus praecox*, *Schizandra nigra*, *Lindera umbellata*, *Aucuba japonica* var. *borealis*, *Helwingia japonica*, *Akebia lobata*, *etc.* A number of herbaceous species have the same limited distribution, such as *Ischaemum anthephroides*, *Ischaemum muticum*, *Apios Fortunei*, *Linum stelleroides*. On the island of Okushiri in particular, where the maximum influence of the warm current is felt, we find such plants as *Cymbidium virens*, *Ardisia japonica* and *Selaginella involvens*, which are common in Honshu but not recorded from anywhere on the mainland of Yezo.

The above are special examples for this south-western district of the

(1) Japanese Jour. of Botany, Vol. I. No. 2, p. 88.

phytogeographical affinity between Honshu and Yezo as a whole, to which I refer again later.

Owing to the absence of high mountains the development of alpine plants is poorest in this district, only a comparatively small number of species occurring on some of the higher ground, such as Kamui-dake and the Yokotsu plateau, and on the volcanoes of Esan and Koma-ga-take, the former being exceptionally rich on account, we may suppose, of the influence of the cold current, while the latter, though offering a more restricted range of species, is remarkable for the fact that some of them extend down the slopes, wherever a suitable soil for other vegetation has not yet developed, to within a few hundred feet of sea-level.

The lakes of this district, Onuma, Konuma and Junsainuma, are rich in water plants.

The sea-shore vegetation of this district is also rich in species, most of them being of southern origin and some of them finding here their northern limit, *e.g.*, *Tetragonia expansa*, *Lysimachia mauritiana*, *etc.* On the other hand a few species, such as *Chrysanthemum arcticum* var. *stipulatum*, *Primula modesta* var. *Fauriae*, *etc.* come down from the north to the Pacific coast of this district,—an interesting fact which seems to be attributable to the somewhat cool moist summer produced by the weak end of the cold current "Oyashiwo."

The second district may be called the south-eastern, facing the Pacific Ocean, and comprising the two provinces Iburi and Hidaka with area about 4588.9 square miles. The wild species number 1015, or 62.31 % of the total number for Yezo, equivalent to 0.221 species per square mile. By reason of the geographical position of this district, its vegetation is on the whole of a southern nature, as illustrated by the occurrence of such plants as *Cyclophorus linearifolius*, *Lycopodium cernuum*, *etc.*, and is closely related to that of the first district. Most of the species found in the first occur also in the second district, and some of them are not recorded in Yezo outside these two, *e.g.*, *Pinus pentaphylla*, *Polypodium hastatum*, *Polystichum falcatum*, *etc.* But the second district differs from the first in the predominance of Fir and Spruce forests, the latter of which may be seen to great advantage in the vicinity of Mt. Tarumai, and the former in the mountainous parts of Hidaka Province. Bogs are also better represented, an area near Shizukari being a very typical example of this formation which has only recently been discovered. On the eastern watershed of the province of Hidaka a number of alpine plants are found on mountains of comparatively low altitude near the coast, such as Mt. Apoi, Mt. Pinneshiri and Mt.

Orokunne. These mountains are palaeozoic in formation, and their vegetation may be strongly influenced by the cool current "Oyashiwo." The alpine species occurring under these special conditions are not infrequently associated with *Pinus pumila*. The following are of special interest:—*Tofieldia Kondoi*, *Alsine verna* var. *borealis*, *Potentilla fruticosa*, *Rhododendron kamtschaticum*, *Arctous alpina*, *Vaccinium Vitis-idaea*, *Veronica senanensis*, *Anaphalis alpicola*, *Crepis burejensis*, *Picris crepioides*, *etc.*

An alpine flora is also well developed in the north-western part of this district on the summits and upper slopes of high volcanoes of comparatively recent activity. Side by side with these "Alpine Meadows" are vast and dense thickets of *Pinus pumila*, illustrating the contrast previously alluded to between the habitats of this pine in Yezo, where it flourishes on volcanoes which have not long been extinct, and in Honshu where it never grows on such mountains (*e.g.*, Mt. Fuji).

The third district is the central section of Yezo, and includes the two provinces of Ishikari and Teshio, with an area of 8928.3 square miles. The number of species growing wild in this district is 1166, 71.58 % of the total number of Yezo species, or 0.131 species per square mile. In this district there are two rich plains in the basins of the rivers Ishikari and Teshio. In the eastern part of the district are a number of high mountains, of which Mt. Yubari and Mt. Ishikari are of palaeozoic origin, and Mt. Taisetsu, Mt. Tokachi and Mt. Teshio are volcanic. Prominent features of the district are the bogs, which are frequent as well as extensive. Their vegetation has already been discussed under "Bogs and Swamps." Other important features of the flora are the alpine meadows on the tops and upper parts of the mountains mentioned above, associated, as elsewhere, with thickets of nothing but *Pinus pumila*. In these alpine meadows the range of species is considerable and includes some of exceptional interest, several of the specimens collected on these mountains being new to science, while others are quite recent additions to the flora of Yezo. In the plains deciduous forests occur here and there, composed of various species of broadleaf trees; they are usually extensive on the banks of rivers and streams and include various kinds of willows. In the deciduous forests of the hills and uplands *Abies Mayriana* and *Picea jezoensis* are usually present. The combinations of tree-species are many and various according to locality. In some places, the conifers reign supreme, as for instance in the north-east where pure forests of Glehn's Spruce are

found on the mountain-slopes or in more or less swampy places, but such exclusively coniferous forests are never extensive in this district.

The fourth district is the eastern part of Yezo, embracing the three provinces Tokachi, Kushiro and Nemuro, with a combined area of 7935.6 square miles and a list of wild species totalling 829 in number, or 50.89 % of the total number recorded in Yezo, equivalent to 0.112 species per square mile. The western part of this district is remarkable for the extensive tracts covered by pure associations of *Phragmites communis*, and for the scattered growth of *Quercus dentata* found on the plains, hills and uplands. In the central plain, along the course of the River Kushiro, there are various swamps, bogs, deciduous forests and natural pastures. The Akan mountain group, situated near the north-western border of the district and comprising the two volcanoes O-Akan and Me-Akan with a lake between them, is a locality of peculiar botanical interest. In the ascent of Mt. Me-Akan one traverses a beautiful rich virgin forest of *Abies sachalinensis* forming a clear timber-line, above which are Pumila associations and alpine meadows. On the upper slopes of Mt. O-Akan is a well-marked zone of *Betula Ermani* with its green foliage standing out between the lower Fir forests and the upper Pumila associations which enclose the summit giving place here and there to alpine meadows on a small scale. In Lake Akan 13 species of waterplants are found, including the interesting *Cladophora Sauteri* referred to above.

In the western part of this district, we see fine forests of *Abies sachalinensis*, to which MAYR gives the variety-name "*nemorensis*." Beautiful forests of *Picea Glehni* also occur, mainly in more or less swampy places. The distribution of arctic alpine plants along the Pacific coast of this district is due to the influence of the cold current "Oyashiwo," as I have already pointed out in my "Flora of the island of Paramushir."

The fifth district is the province of Kitami, which stretches along the north-east coast of Yezo and also includes the two outlying islands Rebun and Rishiri. The area of this district is 5569.7 square miles. The number of species recorded in it is 703, 43.16 % of the total number of Yezo species, or 0.126 per square mile. In general character the vegetation is nearly identical with that of the third district, but it shows a greater predominance of Saghalien elements: for example, *Quercus mongolica* grows along the western coast of Southern Saghalien and along the Okhotsk coast of this district. This relation with Saghalien is

still more evident in the case of the islands Rebun and Rishiri, where such plants as *Geranium erianthum* var. *umbelliforme*, *Scorzonera radiata* var. *humilis*, *Leontopodium discolor*, *Crepis burejensis*, *etc.*, are found.

The altitude and isolated position of Mt. Rishiri would lead one to expect some peculiarities in its vegetation, but actually it is exceedingly similar to that of the high mountains of the Yezo mainland though perhaps the zonal distribution is more marked and there are besides one or two endemic species, *e.g.*, *Zygadenus Makinoanus*. The island of Rebun is rich in alpine species in spite of the absence of high mountains; here alpine meadows, Fir forests, and associations of *Pinus pumila* and *Juniperus rebunensis* are found intermixed even at low altitudes.

The Southern Kuriles. From a botanical point of view these islands should be included as a sixth district of Yezo, for their vegetation is merely an extension of that of the mainland, being composed of elements which are present also in the fourth or eastern district of Yezo. The relationships between the Southern Kuriles and Yezo and of each with Southern Saghalien are dealt with in my "Flora of the island of Paramushir,"[1] and need not be discussed again here.

The Southern Kuriles include the islands of Kunashiri, Shikotan and Etorofu, with their adjacent small islands. The number of species growing wild in these islands is 615 or 37.75 % of the whole number of Yezo species. Of the six districts, therefore, this and the fifth are the two which yield the smallest number of species, and it is of interest to note that there is a gradual diminution in the number along a line drawn roughly from the south-west to the north-east of Yezo, or approximately at right angles to the general direction of the isotherms across the island. Two reasons may be suggested as jointly responsible for this diminution of species from south-west to north-east: firstly the influence of the rich flora of Honshu becomes weakened, in proportion to the distance from its origin, as it extends north-eastwards to the Southern Kuriles, there ceasing abruptly and leaving a gap, which is of the first importance from a phytogeographical standpoint, between the Southern and Northern divisions of the archipelago ; secondly the other elements in the flora of Yezo, *i.e.*, those which have not originated from Honshu, are comparatively poor in species and thus afford insufficient material to counter-balance, from this point of view, the weakening of the Honshu influence.

(1) Jour. of the College of Agric. Hokkaido Imp. Univ. Sapporo, Vol. XI, Pt. 2, pp. 52–54.

13. Relationship between the vegetation of Yezo and of neighbouring regions.

The following list shows for each region the number of species common to Yezo and the ratio borne by this number to the total number of Yezo species.

Region	Number of Species common to Yezo	Ratio to total number of Yezo species
Honshu	1298	79.68 %
Korea	737	45.24 %
Manchuria, Amur and Ussuri region	711	43.65 %
Shikoku and Kyushu	654	40.15 %
China	643	39.47 %
Saghalien	625	38.37 %
Siberia	532	32.66 %
Europe	454	27.87 %
North America	435	26.70 %
Kamtschatka	307	18.83 %
Northern Kuriles	291	17.86 %
Liukiu and Formosa	258	15.84 %
Western Asia	244	14.98 %
Himalaya and Tibet	221	13.57 %
Okhotsk to Ajan	160	9.82 %
India	142	8.72 %
Alaska incl. Aleutian Isl.	122	7.49 %
Africa	118	7.24 %
Oceania	97	5.95 %
Malay Archipelago	71	4.36 %
South America	57	3.50 %
Indo-China	38	2.33 %
Central Asia	22	1.35 %

The first deduction to be made from the above figures is the close relationship between the vegetation of Yezo and that of Honshu. This connection was indeed proved by Professor K. Jimbo in 1890 from the results of his study of the geology of Yezo, and it has to be admitted that, so far at all events as the vegetable kingdom is concerned, "Blakiston's Line" through the Tsugaru Strait is not as important a line of demarcation as its originator considered it.

Secondly the table shows that Korea, Kyushu, Shikoku, China, Manchuria including the Amur district, and Saghalien, each possess more than 38 per cent of the species represented in Yezo. This establishes a close phytogeographical connection between all these regions, which cover the most of ENGLER's "Temperate East-Asiatic" and "Chino-Japanese Trasitionary" regions.

It is further to be noted from the table that the Yezo vegetation is also related to that of Siberia, of Europe and of North America, each having more than 26.7 per cent of the species recorded in Yezo.

Oct. 4, 1924.

BOTANICAL INSTITUTE, COLLEGE OF AGRICULTURE, HOKKAIDO IMPERIAL UNIVERSITY, SAPPORO, JAPAN.

Über die Kontraktion und daraus verursachte Anomalie in der Wurzel von Cycas revoluta.

(Vorläufige Mitteilung).

Von **Kiyohiko WATANABE.**

[Mit 11 Textfiguren].

(Eingegangen am 31. Januar 1925).

In der Studie über *Cycas*-Koralloide[1] hatte ich Gelegenheit, die Kontraktion der Keimwurzel von *Cycas revoluta* wahrzunehmen.

Die Wurzelkontraktion bei Monokotylen und Dikotylen ist verschiedentlich von RIMBACH[2], NORDHAUSEN[3], MASSART[4] u.a. berichtet worden, aber sofern mir bekannt, bei Gymnospermen noch nicht. Ferner, weil die Cycadeen stammesgeschichtlich von grossem Interesse sind, halte ich es nicht für überflüssig, auch diese etwas vernachlässigte Sache ans Licht zu bringen.

Vorliegende Beobachtungen sind nur im Laboratorium gemacht, und da ich bei meiner vorigen Reise nach der Heimat der *Cycas* dieser Erscheinung keine Aufmerksamkeit geschenkt habe, so muss ich eingehendere ökologische Mitteilungen darüber bis meiner nächsten Reise verschieben.

Die Kontraktion ist am auffallendsten bei den Hauptwurzeln der Keimlinge, aber sie ist auch an den adventiv aus Stecklingen getriebenen wahrzunehmen.

Schon drei Monate alte Wurzeln fangen an sich zu kontrahieren, doch ist die Kontraktion nur auf die obersten 3–5^{cm} beschränkt, und die

(1) WATANABE, K., Studien über die Koralloide von *Cycas revoluta* (Tokyo Botanical Magazine **38**, 1924).

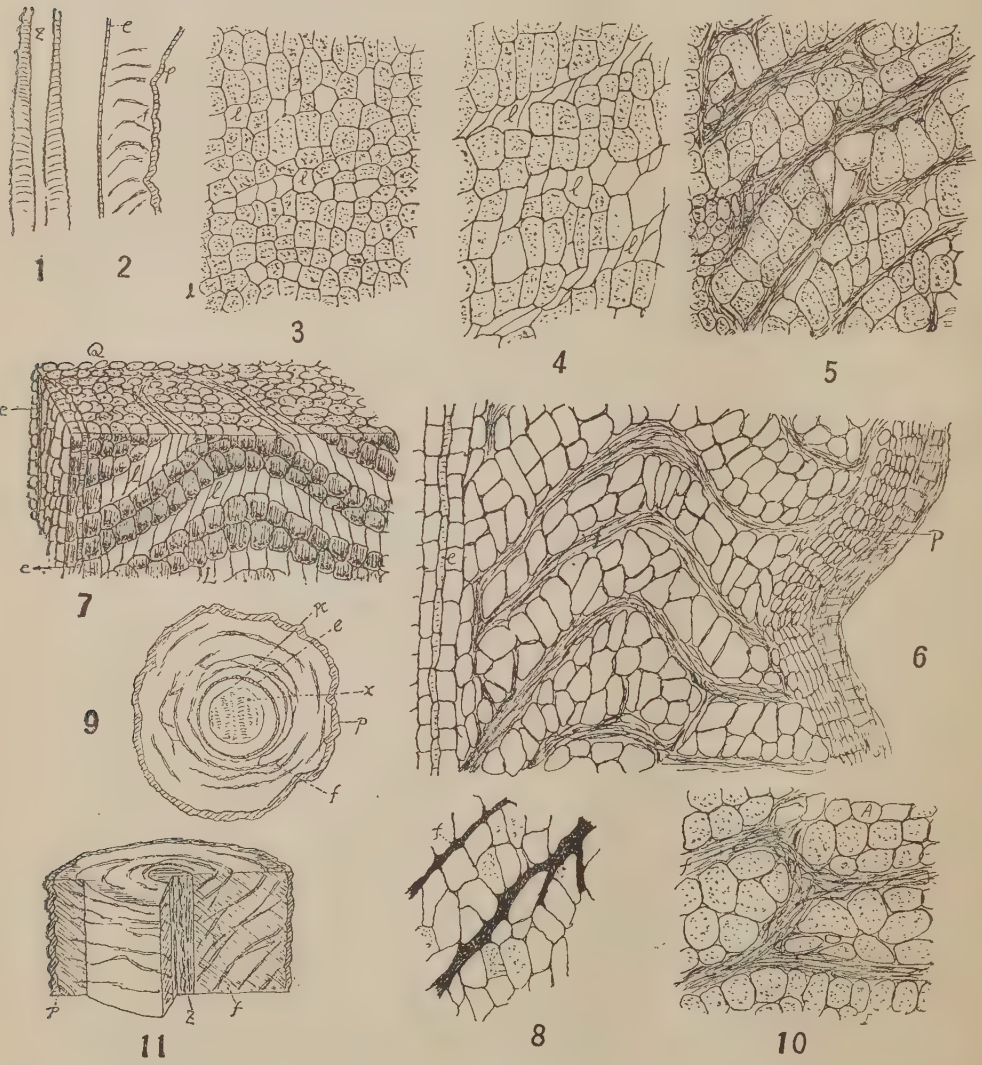
(2) RIMBACH, A., Die kontraktilen Wurzeln und ihre Tätigkeit (FÜNFSTUCKS Beitr. z. wiss. Bot. **2**, 1897). Zur Biologie der Pflanzen mit unterirdischem Spross (Ber. d. Deut. Bot. Ges. **13**, 1895). Physiological observations on some perennial herbs (Bot. Gazette **30**, 1900). Die Wurzelverkürzung bei den grossen Monokotylenformen (Ber. d. Deut. Bot. Ges. **40**, 1922).

(3) NORDHAUSEN, M., Über die kontraktile Luftwurzeln (Flora **105**, 1913).

(4) MASSART, J., Comment les plantes vivaces maintiennent leur niveau souterrain (Bulletin du Jardin bot. de l'Etat. **1**, 1903).

Rechnung ergibt ca. 30 % Verkürzung der am stärksten kontrahierten Stellen. Die äusseren Merkmale der Kontraktion sind, (1) erheblich verminderter (nicht vergrösserter wie gewöhnlich) Durchmesser im oberen Gebiete (Fig. 1) und (2) feine Querrunzeln an der Oberhaut.

In Längenschnitte sind die älteren Leitungssysteme erheblich ver-



bogen, die radialen Wände der Endodermis sind gewellt. In der Rinde sind einige Zellen Querreihen bildend, in einigen Abständen treppenweise zerquetscht worden (Fig. 2). Der Phelloderm ist auch gewellt. Dagegen sind neue Xylemelemente gerade. Die Holzparenchyme sind, zwischen verbogenen Xylemsträngen liegend, überall gespannt geblieben.

Der Querschnitt lehrt uns, dass hier schon erhebliches sekundäres Dickenwachstum des Zentralzylinders stattfindet. In der Rinde erscheinen die zerquetschten Zellgruppen als etwas konzentrische Furchen; die übereinander liegenden stehen oft hier und da durch brückenähnliche Furchen in Verbindung (Fig. 9–10).

Wie oben erwähnt, stimmt das Verhalten von Zentralzylinder und Phelloderm mit dem gewöhnlichen Kontraktions-Typus überein, aber das der Rindenzellen weicht etwas davon ab. Der Zerfall der Rindenzellen geht wie folgt vor sich: im Beginn der Kontraktion entstehen in der Rinde in je drei oder vier Zellenabständen einschichtige zur Wurzel-Längenaxe senkrecht stehende oder etwas nach aussen und oben geneigte Zellenplatten (Fig. 3, *l*), welche immer inhaltärmer werden: Stärke und Plasma vermindern sich, und schliesslich werden diese Zellen entleert. Aber dazwischen liegende Zellen bleiben gesund, und werden sogar dicker. Dann werden diese inhaltarmen Schichten abgedrückt und beginnen zu zerfallen (Fig. 4, *l*).

Mit der fortschreitenden Kontraktion ergeben sich einige den zerbrochenen Schichten anliegende Zellen auch demselben Schicksale, und solche lysigene Interzellularen erscheinen als durch zerbrochene Zellulosemembran dicht gestopfte, stark lichtbrechende Furchen (Fig. 5; Fig. 8, *f*).

Daher haben die Rindenzellen nicht alle das gleiche Schicksal: einige bleiben durchaus gesund, andere gehen früh zugrunde. Weil so die zerbrochenen Zellenreihen, wie Fig. 11 das schematisch erklärt, übereinander liegende horizontale Scheiben oder trichterförmige Wände um Zentralzylinder darstellen, so steht die Oberhaut auch nach der starken Kontraktion stets mittels der gesunden Rindenzellen mit dem Zentralzylinder in Verbindung (Fig. 6).

Die Ursache der Kontraktion ist wohl die Spannung der Rindenzellen und das starke Dickenwachstum der Zentralzylinder.

Die Verminderung des äusseren Durchmessers ist vielleicht auf die durch stark fortschreitenden Zerfall der Rindenzellen verursachte Veränderung der Anordnung derselben zurückzuführen (Fig.6).

Manchmal boten leicht zerstörte Rindenquerschnitte statt der

zerquetschten Furchen konzentrische Zonen der in radialer Richtung abgeplatteten Zellen dar, was auf den ersten Blick die Kambien vortäuschen kann (Fig. 7). Solche Anomalie erinnert an das von Dorety[1] berichtete „extrafascicular cambium" in dem Hypokotyl von *Ceratozamia*.

Wenn auch das „extrafascicular cambium" keine Xylemelemente gebildet hatte, so beurteilte jene Autorin es doch wegen seiner Zellformen als „cambium."

Vielleicht ist es in ihrem Fall echtes Kambium gewesen, doch da an *Cycas*-Keimlingen in Wurzelquerschnitten ein ähnliches Bild durch Kontraktion entstehen kann, so ist es sehr wünschenswert, bei den Studien über „extrafascicular cambium" von Cycadeen diese Vortäuschung nicht zu vergessen. Wie jenes „extrafascicular cambium," kommt dieser anomale Zerfall hier an sekundärer Rinde nicht vor.

Ob solches Verhalten der Rindenzellen die rein mechanische Folge der Kontraktion ist, oder ob jene Zellenplatten durch gewisse phylogenetische Eigenschaften sich zusammenquetschen, ist noch nicht bekannt.

Doch erinnert diese treppenförmige Anordnung ungleich begabter Zellenplatten in primärer Rinde an die Rindenstruktur von *Heterangium*, bei dem nach Williamson[2] horizontale „sclerotic" Zellenplatten in dem gewöhnlichen Grundgewebe liegen. Darüber hoffe ich bei anderer Gelegenheit berichten zu können.

Welche Rolle die Kontraktion an den adventiven Luftwurzeln spielt, die manchmal 2 Meter oder noch länger werdend, den Boden suchen, soll an natürlichen Standorten von *Cycas* studiert werden.

Ob die unterirdischen Stämme von *Cycas revoluta* und anderen Cycadeen nur durch solche Wurzelkontraktion zustandekommen, oder auch andere Faktoren etwas dazu beitragen, werden auch nur Experimente und ökologische Beobachtungen entscheiden, doch bin ich jetzt äusserer Umstände halber verhindert, diesbezügliche Experimente und einschlägige Forschungen sofort zu unternehmen.

Hier gestatte ich mir noch, Herrn Prof. Dr. Miyoshi und den anderen Herren Professoren dieses Institutes für ihre freundliche Anregung und Unterstützung bei meinen Arbeiten herzlichst zu danken.

Botanisches Institut der Kaiserlichen Universität
zu Tokio, Dezember 1924.

(1) Dorety, H.A., The extrafascicular cambium of *Ceratozamia* (Botanical Gazette 47, 1909).

(2) Williamson, W.C. On the organisation of the fossil plants of the coal-measures. Part IV. (Philosophical Transactions, 1873).

Figurenerklärung.

Fig. 1. Kontrahierte Wurzel (Längenschn). *z* Zentralzylinder ×$\frac{2}{3}$.— Fig. 2. Ein Teil derselben; *e* Endodermis, *p* Phelloderm, *f* Furchen der zerquetschten Zellen; vergr.—Fig. 3–5. Aufeinander folgende Stadien des Zerfalls der Rinde (Längenschn); *l* inhaltarm gewordene Zellen, Stärkekörner punktiert. ×40.— Fig. 6. Stark kontrahierte Rinde (Längenschn). *e* Endodermis, *f* lysigene Interzellularen (Furchen), *p* Phelloderm. ×40.— Fig. 7. Modell, das ausserzylindrische kambiumähnliche Bild zu erklären; *e* Endodermis, *l* entleerte Zellen; Q Querschnittfläche, L Längenschnittfläche.— Fig. 8. Längenschnitt der Rinde, dicht mit zerbrochener Membran (schwarz dargestellt) verstopfte Interzellularen zeigt ×40.—Fig. 9. Stark kontrahierte Hauptwurzel eines Keimlings (Querschn). *x* Xylem, *pc* Pericykel, *f* Furchen der zerquetschten Zellen, *p* Phelloderm. ×5.— Fig. 10. Rinde (Querschn.) A nach aussen, I nach innen gerichtete Seite, *f* Furchen. ×40.—Fig. 11. Modell der kontrahierten Wurzelstücke, *f* Furchen, *z* Zentralzylinder, *p* Phelloderm.

Weitere Untersuchungen über die pentaploiden Triticum-Bastarde. I.

Von Hitoshi KIHARA.

(Eingegangen am 21. Februar 1925).

[Mit Tafel XIV].

Bei der Fortsetzung meiner cytologischen Untersuchungen bei *Triticum* habe ich mich besonders mit den Fragen nach der Zuwachsgeschwindigkeit der Pollenschläuche und der Geminibildung aus den elterlichen Chromosomen beschäftigt. Da ich jetzt wegen meiner ausländischen Studienreise gezwungen bin, meine Untersuchungen eine Zeit lang zu unterbrechen, so sei es mir gestattet, hier nur die wichtigsten der erhaltenen Resultate zusammenzustellen, ohne auf die Einzelheiten derselben näher einzugehen, was der Zukunft vorbehalten bleibt.

1. Zuwachsgeschwindigkeit der Pollenschläuche.

Die Zahlen der Chromosomen, die die Gameten der pentaploiden Bastarde F_1 (Emmer × Dinkel) der Chromosomenzusammensetzung 14^b+7^i enthalten schwanken zwischen 14 bis 21.[1] Bei der Tetradenbildung dieser pentaploiden Bastarde ist die Diminution von einigen der isolierten 7 Chromosomen oft bemerkbar, die sich sonst über die Enkelkerne verteilen sollten, und zwar gleichmässig nach dem Gesetze der Wahrscheinlichkeit. Die Frequenz des Vorkommens von verschiedenchromosomigen Gameten weicht in diesem Fall von dem theoretischen Verhältnis 1 : 7 : 21 : 35 : 35 : 21 : 7 : 1 einigermassen ab, denn die minderchromosomigen Gameten treten mehr auf als die mehrchromosomigen.

WATKINS (1924) hat auch die Elimination der Einzelchromosomen bei den Nachkommen des Bastardes *Triticum turgidum+vulgare* eingehend untersucht. Seine mikroskopisch festgestellten Tatsachen hinsichtlich des Chromosomensatzes verschiedener Gameten stimmen mit meinigen sehr gut überein, obwohl er als Versuchspflanzen die 31- und 38-chromosomigen Nachkommen gebraucht hat, während in meinem

(1) KIHARA (1924).

Falle die 29– (*Triticum durum*+*vulgare*) und die 41–chromosomigen (*T. polonicum*+*Spelta*) Pflanzen hauptsächlich zum Versuche dienten. Wie ich schon in meiner vorhergehenden Arbeit[1] bewiesen habe, hängt solche Diminution der Chromosomen bei der Tetradenbildung der F_1-Pflanzen wohl von der Art der Pflanzen ab, die als die Eltern bei der Kreuzung gebraucht werden.

Die durch die oben erwähnte Diminution hervorgerufene gametische Frequenz wird durch die Befruchtungskonkurrenz des Pollens weiter gestört. Dass der Pollen aus den heterozygotischen Pflanzen bisweilen ungleiche Zuwachsgeschwindigkeiten seiner Schläuche aufweist, ist ja durch die Untersuchungen zahlreicher Autoren[2] bestätigt worden. Was die eigentümlichen Spaltungsmodi der Speltoidheterozygoten bei *Triticum* betrifft, so sind unsre Kenntnisse durch die umfangreichen genetischen Untersuchungen von Lindhard (1922), Åkerman (1923), Kajanus (1923) u.a. immer mehr erweitert worden. In einer Arbeit, die fast gleichzeitig mit meiner letzten Abhandlung (1924) erschien, hat auch Winge (1924) versucht, die genetischen Untersuchungsresultaten der obengenannten Autoren bei der Speltoidaberranten weiter cytologisch zu erklären. Nach seiner Meinung konkurrieren beim Wachstum in ein und demselben Griffel die normalen (ABC) und die abnormalen (ABB) Pollenkörner miteinander und er sagt dabei: „Männliche ABB-Gameten werden demnach sicherlich handicapped sein" (S. 252). In meiner obengenannten Arbeit habe ich auch die Resultate der reziproken Kreuzungsversuche mit den 41– und 42–chromosomigen Weizenbastarden mitgeteilt, und dabei habe ich die Ansicht geäussert, dass die Keimschläuche der 21–chromosomigen Pollenkörner viel rascher wachsen dürften als diejenigen der 20–chromosomigen. Damals schien es mir nicht unwahrscheinlich zu sein, dass die Zuwachsgeschwindigkeiten der Keimschläuche des Pollens mit 14–21 Chromosomen im allgemeinen von einander verschieden seien.

Um diese Vermutung zu prüfen und weiter die vollkommene Befruchtungsfähigkeit solches Pollens zu bestätigen, habe ich weiter die Kreuzung zwischen den elterlichen Pflanzen und den F_1-Pflanzen ausgeführt. Die F_1-Individuen wurden als Pollenpflanzen einmal mit den hexaploiden Eltern (Dinkelweizen) und ein andernmal mit den tetra-

(1) Kihara (1924).

(2) Heribert-Nilsson (1924), Correns (1917, 1921, 1922), Brink und MacGillivray (1924).

ploiden (Emmerweizen) gekreuzt, in anderen Worten, habe ich die Zertationskreuzungen ausgeführt. Das Resultat ist aus der folgenden Tabelle ersichtlich:

ZERTATIONSKREUZUNG[1].

Chromosomenzahl der befruchtenden Spermakerne	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	Kreuzungen
Befruchtungs-Frequenz	0	0	1	0	1	2	3	3	(A) *T. Spelta* ♀ × F_1 ♂
	4	0	0	0	0	0	0	0	(B) *T. polonicum* ♀ × F_1 ♂

F_1 = *T. Spelta* ♀ × *polonicum* ♂

Aus diesen Ergebnissen geht es hervor, dass bei der Kreuzung (A) die mehrchromosomigen Spermakerne häufiger die Eier befruchten können als die minderchromosomigen, während bei der Kreuzung (B) die Verhältnisse gerade umgekehrt sind.

Wenn wir die Resultate der beiden Zertationskreuzungen miteinander vergleichen, so scheint es mir sehr wahrscheinlich zu sein, dass die Zuwachsgeschwindigkeit der Pollenschläuche je nach den Arten der Mutterpflanzen verschieden ist. Obwohl die Zahl der zum Versuche verwendeten Pflanzen nicht hinreichen wird, um diese Tatsache endgiltig zu beweisen, so finden wir doch analoge Verhältnisse der Zertation[2] auch bei dem 7–14-chromosomigen Pollen der triploiden Oenotheren[3], welche zweifellos zur Bestätigung unsrer Auffassung herangezogen werden können. Die *Oenothera*-Pollenkörner mit den zwischenliegenden Chromosomenzahlen (8–13) sollen aber nach VAN OVEREEM früher oder später zugrunde gehen, während bei unsren pentaploiden Weizenbastarden diese alle befruchtungsfähig bleiben können.

(1) Die Narben wurden mit Pollen reichlich bestäubt.

(2) VAN OVEREEM hat aber die Zertation der Pollenschläuche nicht berücksichtigt.

(3) Wir fassen das Zahlenverhältnis der befruchtenden Gameten bei der triploiden *Oenothera Lamarckiana semigigas* kurz wie folgt zusammen.

Chromosomenzahl der befruchtenden Gameten	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	Kreuzungen
										♀ ♂
Frequenz in der Zertationskreuzung	3	1	0	0	0	0	1	**10**	3	*Lam. gigas* × *semigigas*
	30	6	0	0	0	0	0	0	0	*Lam. biennis* × *semigigas*
	47	**65**	0	0	0	0	0	2	0	*Lam. lata* × *semigigas*
Frequenz in der Äquationskreuzung	1	2	12	**21**	**25**	19	6	1	0	*Lam. semigigas* × *gigas*

Gleiches Verhältnis ist auch bei *O. biennis semigigas* gefunden worden.

Schon im Jahre 1911 hat Heribert-Nilsson[1] mitgeteilt, dass die Pollenschläuche von *Oenothera Lamarckiana* im eigenen Griffel rascher wachsen können als diejenigen von *Oenothera gigas* im *Lamarckiana*-Griffel. Renner (1917) sagt mit Recht hierüber: „.....das Verhältnis der Wachstumsgeschwindigkeiten zweier Pollenklassen braucht also bei Verbindung mit verschiedenen als Weibchen verwendeten Biotypen nicht immer das gleiche zu sein" (S. 152).

Bei den Äquationskreuzungen (F_1♀ × *T. Spelta*♂[2] und 41-chromosomige Pflanze × 42-chromosomige) kann man sicher sagen, dass die theoretische Häufigkeit verschiedenchromosomiger Gameten (Eizellen) durch die Chromosomendiminution etwas verändert ist, und dass sie jedoch alle befruchtungsfähig sind[3].

Die komplizierten Befruchtungsbeziehungen zwischen den Spermakernen und den Eikernen—oder vielmehr zwischen dem Pollenschlauch und dem Leitungsgewebe im Griffel—hängen wohl von den Veränderungen der Chromosomenzahlen der Nachkommen von den pentaploiden Bastarde ab, welche durch die Konjugation der 14—21-chromosomigen Gameten entstanden sind[4].

2. Kreuzungsversuche zwischen zwei Pflanzen, je mit einer sterilen Chromosomen-Kombination.

Zwei erblich fixierte Individuen mit einer konstanten Chromosomenzahl 40 sind aus einem pentaploiden Bastarde zwischen *Triticum polonicum* und *Spelta* entstanden. Das eine (2–8–31) und seine Nachkommen (2–8–31–) sind zwergig und das andere (3–3–3–6) und seine Nachkommen (3–3–3–6–) halbzwergig (Tafel XIV). Diesen 40-chromosomigen Pflanzen fehlt möglicherweise irgend ein Paar Chromosomen von dem doppelten Satz des Dinkels (42), nämlich aa, bb, cc, dd, ee, ff oder gg. Da es kaum möglich ist, diese 7 Chromosomen morphologisch untereinander zu unterscheiden, so können die verloren gegangenen Chromosomen cytologisch nicht ohne weiteres bestimmt werden. Man kann nur durch die Kreuzungsversuche entscheiden, ob die verloren gegangenen Chromosomen beider Pflanzen identisch sind oder nicht. Zu diesem Zwecke habe ich die folgende Versuche angestellt:

(1) Zitiert nach Renner (1917).

(2) Zwei Pflanzen aus dieser Kreuzung wurden untersucht. Eine hat 39 Chromosomen, während die andere etwa 38 davon besitzt.

(3) Vergl. die Fussnote 3, S. 301.

(4) Kihara (1924).

Tabelle I.

Kreuzungen	Chromosomenkombination der Bastarde	Habitus der Bastarde	
2-8-31-×*T. Spelta*	41=20^{b}+1^{i}	normal	Tafel XIV
T. Spelta×2-8-31-	41=20^{b}+1^{i}	normal	
3-3-3-6-×*T. Spelta*	41=20^{b}+1^{i}	normal	
3-3-3-6-×2-8-31-	40=19^{b}+1^{i}	beinahe normal	

Tabelle II.

Pflanzen	Mittlere Körnerzahl pro		Chromosomenkombination	Zahl der geprüften Ähren
	Ähre	Ährchen		
2-8-31- } 1922 (Sapporo)	14.9	.	20^{b}+0^{i}	15
3-3-3-6 }	20.0		„	
2-8-31-	11.80		„	5
3-3-3-6- } 1924 (Kyoto)	32.60	1.67	„	5
T. Spelta	35.50	1.94	21^{b}+0^{i}	10
3-3-3-6-×2-8-31-	47.10	2.24	19^{b}+2^{i}	10
T. Spelta×2-8-31- } 1924	31.40		20^{b}+1^{i}	5
2-8-31-×*T. Spelta*	41.20	1.96	„	5
3-3-3-6-×*T. Spelta*	40.17	2.09	„	6

Dass die Bastarde zwischen diesen beiden Pflanzen mit steriler Chromosomenkombination, nämlich, (3–3–3–6–) und (2–8–31–), die fertile besitzen, deutet, dass den beiden Pflanzen die nicht identischen Chromosomen fehlen. Es scheint mir am wahrscheinlichsten zu sein, dass dieser Bastard die Kombination $(2\times14+aa+bb+cc+dd+ee+gg)$ $\times(2\times14+aa+bb+cc+dd+ee+ff)$ enthält[1].

Aus den Tabellen I und II ist es ersichtlich, dass der Habitus aller Bastarde normal oder fast normal ist, und dass ihre Fruchtbarkeit im grossen ganzen höher ist als diejenige der Eltern mit steriler Kombination. Besonders bemerkenswert ist, dass der Bastard (2–8–31–×3–3–3–6–) die höchste Fruchtbarkeit aufweist. Die fruchtbare Pflanze mit fertiler Kombination kann durch die Verschmelzung zweier ungleichartigen Gameten entstehen, welche aus den Eltern mit der sterilen Kombination angekommen sind.

Die oben erwähnten bestätigen meine Ansicht, dass bei der Bestimmung des Fruchtbarkeitsgrades und des Habitus der Weizenbastarde die Kombinationsweise der Chromosomen die Hauptrolle spielt.

Botanisches Institut der Universität zu Kyoto, im Februar 1925.

(1) Vergl. Rosenberg (1917) und Ljungdahl (1924).

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Åkermen, Å. (1923): Beiträge zur Kenntnis der Speltoidmutanten des Weizens. (Hereditas **4**).

T. Spelta ♀ × Bastard 2-8-31- ♂ × Bastard 3 3-3-6- ♀ × Bastard *T. Spelta* ♂

Abstracts 1-133

(Referring to the principal papers on Botany and allied subjects which have appeared in Japan mostly during October 1922—March 1924.)

1. Ergänzungen zu meiner Arbeit über die Substanzen, welche die Vermehrung und Garung der Hefe beschleunigen. (Japanisch.) Keizaburô ANDÔ. [Japan. Jour. Exp. Medic. Sc. **8** (1923), 19-87.]

2. Chemische Untersuchungen der Frucht von Evodia rutaecarpa. Yasuhiko ASAHINA. [Acta Phytochem. **1** (1922), 67-89.]

3. Zur Kenntniss des Anemonins. Yasuhiko ASAHINA und Atsushi FUJITA. [Acta Phytochem. **1** (1922), 1-42.]

4. Ueber die Enzyme einiger Saprolegnieen. (Japanisch). Yoshikadzu EMOTO. [Bot. Mag. Tôkyô **37** (1923), (13)-(29), 1 Taf.]

1. Zu unserem Experiment benutzten wir eine neue *Saprolegnia* und eine oogonienlose *Achlya*.

2. In bezug auf die Exoenzyme waren:

a) bei der neuen *Saprolegnia*,
Amylase, Inulinase, Pektinase Zellulase, Raffinase, Invertase, Laktase, Maltase, Emulsin, Salicase und proteolytische Enzyme (sauer, neutral, alkalisch) positiv; Glykolyse, Lipase, Urease, Tyrosinase, Oxydase, Peroxydase und Katalase negativ;

b) bei der oogonienlosen *Achlya*,
Amylase, Inulinase, Pektinase, Zellulase, Raffinase, Invertase, Laktase, Maltase, Emulsin, Salicase, Glykolyse und proteolytische Enzyme (sauer, neutral, alkalisch) positiv; Lipase, Urease, Tyrosinase, Oxydase, Peroxydase und Katalase negativ.

3. In bezug auf die Endoenzyme waren:

a) bei der neuen *Saprolegnia*,
Amylase, Inulinase, Raffinase, Invertase, Laktase, Maltase, Emulsin, Salicase, Glykolyse, proteolytische Enzyme (sauer, neutral, alkalisch), Peroxydase und Katalase positiv; Pektinase, Zellulase, Lipase, Urease, Tyrosinase und Oxydase negativ.

b) bei der oogonienlosen *Achlya*:
Amylase, Inulinase, Zellulase, Invertase, Laktase, Maltase, Emulsin, Salicase, proteolytische Enzyme (sauer, neutral, alkalisch), Peroxydase und Katalase positiv; Pektinase, Glykolyse, Lipase, Urease, Tyrosinase und Oxydase negativ.

4. Unsere neue *Saprolegnia* lässt sich folgendermassen diagnostisieren:
Saprolegnia Tokugawana, EMOTO nov. sp.
Rasen zart, schrank, etwa 1.5 cm lang. Primäre Zoosporangien keulenförmig, cylindrisch, wiederholt durchwachsen, 270-525 μ lang, 20-35 μ dick. Oogonien auf den Nebenästen terminal oder intercalar, rund bis birnenförmig, Durchmesser 60-75 μ. Oogonienmembran farblos, glatt und dünn, mit mittelgrossen Tüpfeln. Oosporen meist etwa 5-20 (1- über 30) in einem Oogonium, Durchmesser 16.5-20.0 μ, zentrisch gebaut. Oosporenmembran ist ziemlich dick und farblos. Antheridien meist vorhanden, entweder diklinen oder androgynen Ursprungs. Sehr oft treten Fortsätze (1-3) aus der Basalwand des Oogoniums im letzteren ein, wie S. *hypogyna*. Gemmen

keulenförmig, birnenförmig, rund bis oval, einzeln oder 1-3 in Reihen geordnet. Aus Wasser von Goldfischbehältern. Verf.

5. On a Race of Portulaca grandiflora which never breeds true. (Japanese). Nakae ENOMOTO. [Idengaku Zassi (Japan. Jour. Genetics) **2** (1923), 117-136]. S. the next entry.

6. Studies on An Ever-segregating Race in Portulaca grandiflora. Nakae ENOMOTO. [Japan. Jour. Bot. **1** (1923), 137-151].

7. On the Influence of Dissolved Alkali out of Cover Glass on Pollen Germination (Japanese.) Kazuo GOTOH. [Bot. Mag., Tôkyô **38** (1924), (65)-(75).]

The rate of pollen germination is remarkably influenced by H-ion concentrations. It is pointed out that cover glass used in the study on pollen germination should be necessarily non-alkaline, especially in the hanging-drop culture. Alkali which is dissolved out of alkaline glass changes the H-ion concentration of germination liquid, and thereby the exact result of the experiment is not to be expected. This precaution is the more necessary, the weaker the buffer action of the liquid is. This applies also to the case of slide glass. Author.

8. The Nature of the Carbohydrates in the Leaf, Stem and Tuber of Amorphophallus Konjaku and their Variations in Amount under Different Conditions. Kiko GOTO. [Jour. Biochem. Tôkyô **1** (1922), 201-211.]

9. Genetic Studies of the Corolla-Design in the Morning Glory. (Japanese). Tokio HAGIWARA. [Bot. Mag. Tôkyô **36** (1922), (205)-(225), 2 figs.]

Of all the coloured flowers of the Morning Glories, one having a white ring at the margin of the corolla is the most common and called the "Hukurin" by the Japanese gardeners.

That the factor referring to this white ring acts as a simple Mendelian dominant to the normal has already been noticed by TAKEZAKI, MIYAZAWA, IMAI and the author. At the same time TAKEZAKI found that some "Hukurin" is recessive to the normal which was confirmed by my own experiments.

The "Star" is the other corolla-design somewhat like the "Hukurin" but the peripheral white is not quite of the same width throughout the petal as in "Hukurin," but is especially wide between each corolla-lobe and widely zigzag along the upper margin of the corolla. In a word, "Star" is a design in which only the central part of the corolla is coloured, forming a star-pattern.

In 1916 the author made several crossings between the various varieties for the purpose of studying the inheritance of this character and found that the factor referring to the "Star" has the interactive relation to the "Hukurin." The factor hypotheses resulting from these experiments are as follows:

C.....the factor for the flower colour;
c.....the factor for white;
F.....the factor for "Hukurin";
f.....the factor for the normal, totally coloured flower;
S.....the factor for making the "Star" pattern on the corolla in the presence of homozygous condition of the factor **C** and **F**;
s.....the factor for not having the above action.

The genotypic constitution of the totally coloured flower corresponds to **CCffss**, of "Hukurin" to **CCFFss** and of "Star" to **CCFFSS**.

Hybrids between the varieties "Hukurin" and "Star" do not resemble any one of their parents, but are intermediate in design between the "Star" and the "Hukurin," and the offspring are composed of "Hukurin," intermediate and "Star" in the proportion of 1: 2: 1.

But the hybrid between "Star" and the white flower variety, which, crossed with the totally coloured one, gives the hybrid "Hukurin", was "Hukurin".

So the genotypic constitution of intermediate must be **CC^{r}FSs.** Author.

10. Genetic Studies of Flower-colour in the Morning Glory. (Japanese). Tokio HAGIWARA. [Bot. Mag. Tôkyô **37** (1923), (37)-(62), (71)-(84), 1 fig.]

Though the flower-colours of the Morning Glory are various, they may be classified into four groups, blue, purple, scarlet, and dark red, there being besides yellow and white colours. The fact, why there are so extraordinary varieties of colours that we can not name them one by one, is owing to the fact that each colour belonging to the every one of these four groups is respectively deep or pale, dark or light, etc. The factors producing these colours are as follows. **C**, the fundamental colour factor ; **c**, that for white flower. **R**, that producing blue colour with **C**, **P**, **B** ; **r**, that producing dark red with **C**, both in the presence or absence of the other colour factor. **P**, that producing blue colour with **C**, **R**, **B** ; **p**, that producing scarlet colour with **C**, **R**. **B**, that producing blue colour with **C**, **R**, **P**, but purple colour with **C**, **R**, **p** ; **b**, that producing purple colour with **C**, **R**, **P**. **K**, that having the complementary relation to **C**, and causing colour factors to develop the colouration with **C** ; **k**, that not having the activity to develop the colouration with colour factor, and probably producing yellow colour with **Y**. **Y**, that concerning yellow ground colour, and probably producing yellow with **k** ; **y**, that concerning white ground colour, and producing white with **k**. From this factor hypothesis, the genetical formula of these groups may be expressed as follows, only in respect to the corolla colour,

blue colour group.....**BPRKC**,
purple colour group.....**BpRKC, bPRKC**
scarlet colour group.....**bpRKC**,
dark red colour group.....**bp^{r}KC, Bp^{r}KC, BP^{r}KC, bP^{r}KC**

The blue colour group is the most epistatic, the dark red colour group the most hypostatic. From the description found in a certain old Japanese book about this plant and its genetic behaviour, I consider that the blue-coloured race of this plant corresponds to purple "wild type" of Sweet Pea. The white flower is complex genotypically though it is phaenotypically simple ; for example, according to this factor hypothesis the various genotypes of the white flowers not having the factor **Y** are twenty-four. A coupling having the gametic ratio about 3.5 : 1 : 1 : 3.5 takes place respectively between each of colour factors, **b** and **P**, and the tube factor (t_1) which, in its turn, is linked with tube factor (t_2).

Moreover, a coupling having the gametic ratio about 70 : 1 : 1 : 70 takes place between the colour factor referring to the scarlet colour (**p**) and the tube factor (t_2). Depending upon the chromosome hypothesis these four factors may be located lineally on the same chromosome, in the order of **p**, t_2, t_1, **b**. Mr. IMAI reported that a linkage having high intensity takes place between the factor concerning yellow leaf(**g**) and the factor concerning dark red colour (**r**), therefore these two factors must be located nearby on the same chromosome. As it is considered that the relation between the factors **r**, **g** and **b**, **p**, is a free assortment, the above colour factor **r** may be on the chromosome different from the one on which the other colour factors **b** and **p** are located. Author.

11. On the Variation of the Fructification in Different Races of Potato. (Japanese.) Takesi HATAKOSI. [Idengaku Zassi (Japan. Jour. Genetics) **2** (1923), 103-106].

It is the well-known fact, that the fruiting power of potato-plants is very weak. The following observations refer to various races of potato cultivated in the Agricultural Experiment Station in Iwateken. The quantity of pollen produced is very various according to different races. It is the general rule that in those which produce its little quantity the pro-

portion of imperfect pollen of small size is much larger than in those which produce it abundantly. In some races, such as Nagasakiaka, Akauma, etc. no flowers are produced at all, while in others, such as Snowflake they are produced but fall down before opening.

Potato-plants are rarely visited by insects so that the fertilisation is not entomophilous. In those races which produce much pollen fruits may be formed naturally, though there are some exceptions. On the contrary, in those which produce little pollen they are formed naturally on rare occasions ; the author has artificially fertilised such races with pollen derived from those which produce much pollen, and it was then found that in many cases fruits may be grown to a certain stage, but have fallen down before their ripening, except in the race Nemuro.

Author.

12. The Prolamin of Coix lacryma L. Gisaburo HATTORI and Shigeru KOMATSU. [Jour. Biochem. Tokyo **1** (1922), 365-369.]

13. Studies on the Anthracnose of Flax. (Japanese.) Makoto HIURA. [Jour. Soc. Agric. Forest. Sapporo **15** (1923), 1-23.]

See this No. p. 113—132.

14. Revisio Graminum Japoniae I. Masaji HONDA. [Bot. Mag., Tôkyô, **36** (1922), 111-116.]—In this paper the four following items are contained.

1. The three varieties and two forms of *Arundinella anomala* STEUDEL.

2. The reduction of the genus *Zoysia,* WILLDENOW to *Osterdamia,* NECKER on account of the priority, owing to the investigation of Dr. HITCHCOCK, the America botanist. Our species belonging to this genus are as follows :—

Osterdamia japonica (STEUDEL) HITCHCOCK.
Osterdamia Zoysia (WILLDENOW) HONDA.
a. typica HONDA.
β. tenuifolia (WILLDENOW) HONDA.
Osterdamia Matrella (LINNÉ) KUNTZE.
Osterdamia sinica (HANCE) HONDA (This combination being not right, it is corrected in my second paper.)
Osterdamia liukiuensis HONDA sp. nov.
Osterdamia macrostachya (FRANCHET et SAVATIER) HONDA. (This plant is HACKEL'S so-called *Ischæmum muticum.*)

3. The two species of *Paspalum.*

Paspalum formosanum HONDA sp. nov.
Paspalum dilatatum POIRET (Species of Bonin Island. New to the Japanese flora.)

4. *Eriochloa polystachya* H. B. et K. or *Eriochloa annulata* KUNTH is changed to *Eriochloa ramosa* (RETZIUS) KUNTZE. (The plant which is called under this scientific name, is to be divided in two distinct species by further investigation. The details will be in the third report.)

15. Revisio Graminum Japoniae II. Masaji HONDA. [Bot. Mag., Tôkyô, **37** (1923), 21-26].

This paper is composed of the correction of my *Osterdamia sinica* (*O. sinica* HONDA to *O. sinica* KUNTZE) and some new or remarkable species of *Panicum.* The summary is as follows :—

1. *Panicum excurrens* distinctly differs from *Panicum plicatum.*
2. The description of the new species *Panicum Nakaianum.*
3. *Panicum flavidum* or *P. flavidum* var. *distans* is changed to *Panicum distans* TRINIUS.

4. *Panicum punctatum* HAYATA (non BURMANN) is really *Panicum geminatum* FORSKAL.

5. *Panicum prostratum* LA MARCK is to be transferred to *Panicum reptans* LINNÉ on account of the priority.

6. *Panicum barbipedum* HAYATA is only a deformed form of *Panicum reptans* LINNÉ.

7. *Panicum distachyum* HACKEL (non LINNÉ) is the variety of the type, that is *P. distachyum* LINNÉ var. *brevifolium* WIGHT et ARNOTT. Dr. HAYATA's *Panicum pseudodistachyum* is to be corrected as *P. distachyum* LINNÉ var. *pseudodistachyum* HONDA.

8. *Panicum patens* LINNÉ forma *latifolium* HONDA, a new form, is recognised among the specimens of Liukiu and Formosa.

9. The scientific name *Panicum acroanthum* STEUDEL is properly changed to *Panicum bisulcatum* THUNBERG on account of the priority of nomenclature. Author.

16 Revisio Graminum Japoniae III. Masaji HONDA. [Bot. Mag., Tôkyô, **37** (1923) 113-124.]

In this article the author has reported the following matters.

1. *Paspalum distachyon*, POITEAU to be added to the Formosan flora.

2. The descriptions of two new species of *Miscanthus* from Formosa, *M. flavidus* and *M. Matsudae*.

3. *Eriochloa ramosa*, KUNTZE, reported in "the Botanical Magazine Tôkyô" **36** (1922) 116 by the author is to be partly emended and changed to the new species, *Eriochloa Hackelii*.

4. The adoption of the genus *Hymenachne*, BEAUVOIS's *Panicum amplexicaule*, RUDGE is to be naturally transferred to *Hymenachne amplexicaulis*, NEES.

5. By the acknowledgement of the genus *Sacciolepis*, NASH. the scientific names of our two grasses are to be transferred as follows :—

Panicum indicum, LINNÉ = *Sacciolepis indica*, CHASE.

Panicum indicum var. *oryzetorum*, MAKINO = *Sacciolepis oryzetora*, HONDA.

6. BEAUVOIS's *Echinochloa* is to be adopted as a distinct genus, and by this standpoint I have classified *Echinochloa crusgalli* BEAUVOIS as follows :—

Echinochloa crusgalli, BEAUVOIS
- Subsp. a *genuina*, HONDA
  - var. *α typica*, HONDA
  - var. *β echinata*, HONDA
- Subsp. b *submutica*, HONDA
  - var. *α typica*, HONDA
  - var. *β hispidula*, HONDA
- Subsp. c *colona*, HONDA
  - var. *α typica*, HONDA
  - var. *β edulis*, HONDA

17. Revisio Graminum Japoniae IV. Masaji HONDA. [Bot. Mag., Tôkyô, **38** (1924) 49-59.]

This paper contains the following 11 items.

1. The descriptions of four new *Ischaemum*-species from Formosa: *I. nodulosum*, *I. akoense*, *I. Tashiroi*, and *I. selaceum*.

2. HACKEL's variety *stenoptera* of *Ischaemum anthephroides*, MIQUEL is to be distinguished from the type and changed to the name *Ischaemum stenopterum*, HONDA.

3. The publication of NAKAI's *Ischaemum coreanum*, with my description of it.

4. *Ischaemum crassipes* var. *Hondae*, NAKAI is partly te be transferred to *I. crassipes* var. *aristatum*, NAKAI, and partly to *Ischaemum Hondae*, MATSUDA. The new variety of the

author, *tomentosum* of the latter species is described here.

5. The new scientific name *Ischæmum Urvilleanum*, KUNTH var. *ischæmoides*, HONDA is determined by Bonin-species.

6. *Ischæmum ciliare* var. *scrobiculatum*, HONDA, *I. timorense* var. *pagnense*, HACKEL and *I. guianense*, KUNTH are newly recognised from Formosa.

7. The establishment of the new genus *Eulaliopsis*. (The type species is *E. angustifolia*, HONDA basing upon HACKEL'S *Ischaemum angustifolium*.)

8. The adoption of the genus *Eulalia*, KUNTH. *E. Tanakae*, HONDA and *E. quadrinervis*, KUNTZE in Japan, and E. *speciosa*, KUNTZE and its variety *modesta*, HONDA in Corea.

9 The new variety, *Isachne Myosotis* var. *minor*, HONDA is the tiny form from Yakushima-Island.

10. *Isachne heterantha*, HAYATA from Formosa is the synonym of *I. dispar*, TRINIUS.

11. *Panicum muscarium*, TRINIUS was discovered in Formosa.

18. On the Nuclear and Cell Division of a Plankton-diatom Coscinodiscus subbuliens, Jörgensen. Jiro IKARI. [Bot. Mag. Tôkyô **37** (1923), 96-108, 2 pls. and 2 figs.]

The division of the chromatophore takes place almost always before the nuclear division, and then the pyrenoid within it is divided before the chromatophore itself.

One of the most remarkable facts about the nuclear division is the migration of the nucleus just before this process: the latter which lies usually at the centre of the epitheca begins to move toward the girdle side, and on reaching the valvar margin it travels to the hoop where it takes a new position almost in contact with the cell-wall. Soon afterwards spirem threads are formed, and the latter develop into a number of slender chromosomes, which lies between 12-20. The central spindle then appears near the nucleus, gradually gets into the nuclear cavity through its membrane, and the nuclear division goes into the end. No true centrosome was found, so the author was not able to establish the centrosome origin of the central spindle, as it was the case in some diatoms according to the well-known observations of LAUTERBORN and KARSTEN. Author.

19. Erblichkeitsversuche an einigen Sippen von Plantago major. Seiitirô IKENO. [Japan. Jour. Bot. **1** (1923), 153-212, 4 Tafeln, 4 Tabellen und 2 Abbild.]

20. Nachträge zu meiner Angabe über Plantago contorta. Seiitirô IKENO. [Japan. Jour. Bot. **2** (1924), 39-44.]

21. Studien über die Vererbung der Blütenfarbe bei Portulaca grandiflora. II. Mitteilung. Seiitirô IKENO. [Japan. Jour. Bot, **1** (1924), 45-62.]

22. Genetic Studies in Morning Glories. VII. (Japanese). Yoshitaka IMAI. [Bot. Mag. Tôkyô **37** (1923), (37)-(41)]

The so-called smooth stem found in the Japanese Morning Glory is not entirely destitute of hair, but it is poorly developed and almost glabrous on its upper part in the mature plant.

The F_1 plants which were obtained by a cross, glabrous×hoary, segregated into respective parental characters in the F_2 generation. Some glabrous F_2 individuals, however, threw hairy stems in the subsequent generation. The experimental data show the presence of two factors which are responsible for the occurrence of dominant and recessive hairs. Author.

23. Genetic Studies in Morning Glories. VIII. On the Linkage Value of Yellow Leaf and Brown Flower. (Japanese.) Yoshitaka IMAI. [Bot. Mag. Tôkyô **38** (1924), (9)-(16).]

By examining MIYAZAWA'S data the author has already pointed out elsewhere the occur-

rence of linkage between yellow leaf and brown flower. But the segregation being represented in a repulsion fashion, the data were not fitted for determining the cross-over percentage in a case of such strong linkage. From this point of view the author made some crosses which were expected to obtain the coupling segregation. By the data obtained from these hybrids the cross-over percentage was determined, the frequency being 1.04% in average. On such a circumstance in the repulsion segregation, there may be expected only one double recessive among every about forty thousands observed, and actually this was the case. Author.

24. Genetic Studies in Morning Glories. IX. On the Behavior of Factor for the Willow Leaf in Pharbitis Nil. (Japanese.) Yoshitaka IMAI. [Bot. Mag. Tôkyô **38** (1924), (27)–(44), 11 figs in text.]

The willow leaf behaves as a recessive to the normal and they may constitute multiple allelomorphs with the maple leaf. The order of dominancy of these three forms is normal (**M**) — maple (**m**) — willow (**m'**). In the combination of the other leaf form factors, such as heart, "sasa," "rargiku" etc., the willow produces a particular leaf form in every case.

On the willow plants there appear sometimes the maple branches as a vegetative sport and a few maple mutants may also be found in the segregating families. The mutation is caused by the transformation of the factor $\mathbf{m}'$ to **m**. The frequency of mutation was determined by the actual data. Author.

25. Genetic Studies in Morning Glories. X. On the Behavior of Defect Leaf and "Gejigeji"-Variegation in Pharbitis Nil. (Japanese.) Yoshitaka IMAI. [Bot. Mag. Tôkyô **38** (1924), (59)–(65), 1 fig.]

In the progeny of a plant from unknown origin the author obtained some individuals having a few defective leaves mixed among the normal ones. The defective parts of the leaves were quite irregular in form. This irregularity may sometimes appear even in the cotyledonous leaves. The defective parts are often accompanied by a very faint variegation, which may be mistaken for a sympton of disease. This abnormality was proved by the author's experiments to be a Mendelian recessive to the normal. Besides the ordinary abnormals which have a few defective leaves among the normal ones, there occur some false normals with perfectly normal leaves, but carrying the defective factors in full dose. Such false normals behave in the same way as the ordinary defectives, giving rise in their self propagated progenies to many defective and a few false normals. From the data obtained the author found that the rate of appearance of the false normals is about 13%, although the value may be expected to vary with the conditions under which the plants are raised.

In some crosses of green and common variegated leaves there appeared some "gejigeji" or ghost variegateds in the F_2 generation, the ratio of three forms, green, common variegated and "gejigeji," being as 12 : 3 : 1. This result suggests that the "gejigeji" marking is a variegated leaf differing in one recessive factor from the normal variegated. The characteristic of the "gejigeji" leaves is that of the peculiar one resembling somewhat the faint variegation of the defective leaves. Author.

26. Über die Vererbung der Blütenfarbe einiger Sippen von Papaver somniferum. (Japanisch). Makoto ISHIHARA, Riichiro KÔKETSU und Hitoshi KOJIMA. [Idengaku Zassi (Japan. Journ. Genetics) **1** (1922), 185–193].

Es wurden konstatiert, 1) dass die violette Farbe auf die weisse dominiert, 2) dass das Spaltungsverhältnis in F_2-Generation der Bastardierung zwischen der violetten und der weissen violett 9 : rosarot 3 : weiss 4 ist, und 3) dass es in den rosaroten Sippen zwei verschiedene äusserlich unterscheidbare und zwar stark-rosarote und schwach-rosarote gibt, welche eine homozygot und die andere heterozygot in Bezug auf die Farbenfaktoren ist. Die Verfasser

erklärten diese Ergebnisse durch die Annahme des **A**-Faktors, welcher die rosarote Farbe bedingt, und des **B**-Faktors, der durch das Co-Dasein mit **A** violette Farbe verursacht: die violetten Zygoten sollen nämlich **ABAB, ABaB, ABAb** oder **ABab,** die stark-rosarote **AbAb,** die schwach-rosarote **Abab** und die weissen **aBaB, aBab** oder **abab** sein. Richtigkeit dieser Annahme wurde durch genaue Prüfungsversuche festgestellt. Autoref.

27. Ueber den auf der Binse parasitisch lebenden Pilz Cercosporina juncicola sp. nov. Mikio KASAI. [Ber. Ôhara Inst. f. landw. Forsch. **2** (1922), 225-232. Vgl. die nächste Nr.

28. Kurze Mitteilung über den auf der Binse parasitistisch lebenden Pilz Cercosporina junciola n. sp. Mikio KASAI. [Japan. Jour. Bot. **1** (1923), 105-110.]

29. Cultural Studies with Gibbierella Saubinetii (Mont.) Sacc. which is parasitic on Rice-plant. Mikio KASAI. [Ber. Ôhara Inst. landw. Forsch. **2** (1923), 259-272.]

Gibberella Saubinetii (Mont.)Sacc. which is found among others parasitic on rice-plant attacks firstly, its germinating seeds in the irrigated seedbeds; secondly, its heads causing so-called scab or head-blight; and thirdly, its stem-nodes causing their rotting. The author has performed a series of cultures from conidia as well as ascospores, and it was found that the culture from condidia gives rise to the perithecial stage and vice versa. The conidial form of this fungus called *Fusarium gramineum* Schwarbe has sometimes been taken for a special fungus, but the results of the author's present studies have definitely proven that *Fusarium* belongs to the life-cycle of *Gibberella*. The hyphae which lie on or near the surface of substrata contain the pomegranate red or yellow coloring matter consisting of a few granules. Its solubility in various reagents, as ethyl-alcohol, chloroform, benzene, ether, etc. etc. was examined. Author.

30. Feuerbrand und Baume resp. Wälde. (Japanisch.) Masaru KAWADA und Yosizô YANAGIDA. [Zeitsch. f. Forstbauuntersuchungen. Spezialnr. (1923), 1-33.]

Um 1. September 1923 wurde mehr als die Hälfte der Stadt Tôkyô zu Aschen reduziert worden, wegen der auf heftiges Erdbeben folgenden furchtbaren Feuerbrunst. Der vorliegende Aufsatz enthält verschiedene diesbezüglichen Sachen, von denen die folgenden hier zitiert werden als die botanisch interessanten.

Verschiedene Bäume sind durch das in ihrer Nähe brennenden Feuer mehr oder weniger verfärbt worden und es gilt als allgemeines Regel, dass die Nadelbäume (wie *Pinus, Cryptomeria, Podocarpus* usw.) in dieser Beziehung weniger widerstandsfähig sind als die Laubbäume (wie *Quercus, Pasania, Salix, Acer, Aphananthe* usw.), ausgenommen *Ginkgo biloba,* welche dabei sich viel widerstandsfähiger als die letzteren erwiesen hat. Unter den Laubbäumen sind *Pasania cuspidata, Quercus glauca* und *Fatsia japonica* die widerstandsfähigsten Arten, während *Tuonabo japonica* und *Enkyanthus japonicus* die schwächsten sind.

Die durch das Feuer mehr oder minder beschädigten Baumarten begannen im allgemeinen nach einiger Zeit wieder zu wachsen, wobei man im allgemeinen sagen kann, dass die gegen das Feuer resistenten Arten schneller zum Wiederwachsen kommen können als die schwächeren, so z. B. haben die Verf. eine *Ginkgo biloba* gesehen, von welcher alle Blätter ausgestorben sind und wobei doch schon am 23. September grüne Knospen sehr reichlich zu beobachten waren. Die Verf. haben auch viele Fälle gefunden, wobei trotzdem die überirdischen Teile so stark gebrannt wurden, dass sie gestorben oder sogar schwärzlich geworden sind, doch bald neue Sprosse entwickelt sind. Autoref.

31. On the Physical Nature of Protoplasm of the Wheats. (Japanese). Hitoshi KIHARA. [Journal of the Society of Agriculture and Forestry, Sapporo, Japan. Year **15** (1923), 55-68.]

The pollen grains of cereal plants burst easily in tap water or dilute solutions. Although this phenomenon depends mostly on their own high osmotic pressure, the colloidal nature of protoplasm also must be considered as an important factor. Pollen-plasm with diminished viscosity shows weak resistance to the inner pressure. On the contrary, if its viscosity is raised, bursting of pollen grains hardly occurs, even with their high osmotic pressure. In the extreme case such dehydration will cause irreversible coagulation of protoplasm.

Applying this bursting phenomenon of pollen grains the writer examined the effects of H-ion concentrations on protoplasm of several species of *Triticum*, with special reference to the phylogenetical classification of SCHULZ.

By addition of regulated amounts of HCl or KOH and water to a certain nutrient solution, a wide range in the H-ion concentrations in the acid side was obtained. Bursting of pollen in the hanging drop was observed exactly after thirty minutes, and its grades were indicated by the number of burst pollen grains expressed in percentage. Non-alkaliine cover-glass of ZEISS was used.

The curves showing percentages of bursting pollen grains in the three strains of wheats are different from one another. Generally the pollen grains of the Dinkel group burst most easily, next come those of the one-grained wheat, and lastly, those of the Emmer group. The difference of osmotic pressure of each strain plays no principal part. In each strain the reaction of protoplasm of pollen to H-ion concentrations, i.e. the fluctuation of the percentage curve of bursting pollen grains is almost equal.

In the hybrid generations the reaction of pollen protoplasm to H-ion concentrations shows tendency of segregation, together with other morphological characters as well as the number of chromosomes. Author.

32. Cytologische und genetische Studien bei wichtigen Getreidearten mit besonderer Rücksicht auf das Verhalten der Chromosomen und die Sterilität in den Bastarden. Hitoshi KIHARA. [Memoirs of the College of Science, **1** (1924), 1–200, 5 Taf. und 117 Textfig.]

Im ersten Teile dieser Arbeit sind die karyologischen Untersuchungen der Pollen- sowie Embryosackmutterzellen der wichtigen Getreidearten und ihrer Bastarden mitgeteilt. Die Chromosomenzahl von *Triticum-*, *Aegilops-*, *Secale-*, *Hordeum-* und *Avena*-Arten ist zuerst genau bestimmt worden. Die Grundzahl ist 7. Bei den meiotischen Kernteilungen der Bastarden wurde das Verhalten der bivalenten und univalenten Chromosomen besonders eingehend studiert.

Die triploiden (7+14) und tetraploiden (7+21) Bastarde sind völlig steril. Sie haben locker verbundene bivalente Chromosomen, deren Zahl zwischen 4-7 resp. 0-3 schwanken.

Die pentaploiden Weizenbastarde zwischen der 14-chromosomigen Emmer- und der 21-chromosomigen Dinkelreihe haben 35 Chromosomen, entsprechend der Summe der Chromosomenzahl von elterlichen Pflanzen. In der heterotypischen Kernteilung der Pollen- und Embryosackmutterzellen bilden 14 Dinkelchromosomen 14 bivalente mit ebensovielen Emmerchromosomen, während die 7 überschüssigen Dinkelchromosomen als die univalenten bleiben. Die heterotypische Kernteilung der pentaploiden Bastarde ist in bezug auf die 14 bivalenten Chromosomen eine normale Reduktionsteilung und in bezug auf die 7 univalenten eine Längsspaltung. Die homöotypische Kernteilung dieser Bastarde ist in bezug auf die 14 Dyadenchromosomen, die von den 14 bivalenten in der heterotypischen Kernteilung herstammen, eine Äquationsteilung. 7 überschüssige Chromosomen verteilen sich ungespalten in 4 Mikrosporen, und zwar nach dem Gesetz der Wahrscheinlichkeit, weshalb die dabei erzeugten Pollenkörner 14+i Chromosomen erhalten, wobei i = 0-7.

Die Chromosomenzahl der F_2-Nachkommen der pentaploiden Bastarde beträgt 28, 29, 30, 31.....42. Die F_2-, F_3-,.....Nachkommen der pentaploiden Bastarde werden je nach den Chromosomenkombinationen in fertile und sterile Pflanzen eingeteilt. Die Pflanzen mit

der sterilen Chromosomenkombination sind meistens abgeschwächt oder völlig steril. Die Pflanzen mit der fertilen Chromosomenkombination werden ferner in zwei Gruppen eingeteilt, nämlich :

a) *Verminderungsgruppe :* Die Chromosomenzahl dieser Pflanzen beträgt weniger als 35. Sie vermindert sich alljährlich in den weiteren Generationen, bis sie die konstante Chromosomenzahl 28 erreicht ;

b) *Vermehrungsgruppe :* Die Chromosomenzahl dieser Pflanzen beträgt mehr als 35. Sie vermehrt sich alljährlich in den weiteren Generationen, bis 42 als konstanter Endwert erreicht wird.

Die Sterilität dieser Bastardnachkommen und ihre Sterblichkeit sind von den fertilen und sterilen Chromosomenkombinationen abhängig. Bei den 36-42-chromosomigen Pflanzen und den 29-34-chromosomigen mit der fertilen Kombination erhöht sich die Fertilität, entsprechend der Zu- oder Abnahme der Chromosomen.

Im zweiten Teile dieser Arbeit ist die Vererbungsweise der pentaploiden Weizenbastarde mitgeteilt. Der Habitus der 28-chromosomigen Nachkommen dieser Bastarde ähnelt meistens mehr oder weniger dem Emmertypus, während die 42-chromosomigen den typischen oder annähernd typischen Dinkelhabitus annehmen.

Im Anhang der Arbeit sind die wichtigen Resultate der reziproken Kreuzungsversuche mit den 42- und 41-chromosomigen Pflanzen erwähnt. Die Zuwachsgeschwindigkeit der 21-chromosomigen Pollenkörner ist grösser als diejenige der 20-chromosomigen. Ferner ist auch der Kreuzungsversuch zwischen einer fertil und einer steril kombinierten Pflanze ausgeführt worden. Diese Nachkommen haben fertile Kombination und weisen hohe Fertilität auf. Autor.

33. Cytological Studies on Rumex L. I. Chromosomes of Rumex Acetosa L. (Japanese). Hitoshi KIHARA and Tomowo ONO. [Bot. Mag. Tôkyô **37** (1923), (84)-(90), 18 figs.]

1) The diploid chromosome number of *Rumex Acetosa* L. is 15 in a certain male plant, though we are not yet sure, whether all male plants have invariably 15 diploid chromosomes.

It may be remarked that previously the number of chromosomes in the same species was reported to be 8(x) and 16(2x) by ROTH (1908) in both male and female plants. The chromosomes of other species of *Rumex* are in multiples of 8 according to several investigators.

2) The present paper is chiefly devoted to describe the behavior of chromosomes in heterotypic and homotypic divisions in pollen mother cells. In the heterotypic metaphase of the male plant, there are 6 bivalent autosomes and one tripartite chromosome. The behavior of the tripartite chromosome during the maturation division resembles remarkably that of the idiochromosome of the mantis (OGUMA, 1921).

3) The tripartite chromosome consists of 3 parts, namely m_1, M and m_2. These 3 parts are connected end to end in the order above mentioned.

4) In the heterotypic anaphase the tripartite chromosome is divided transversery (not longitudinally) in 2 daughter nuclei. While M in the middle goes to one pole, m_1 and m_2 go to the other.

5) The M is the largest chromosome and can easily be distinguished from other chromosomes. The m_1 and m_2 are much smaller than M. They can not easily be distinguished from other autosomes in their size and form.

6) In the homotypic division 6- and 8-chromosomed methaphase plates were found as expected. The 7-chromosomed plates contain always one M chromosome.

7) The homotypic division is normal equational one. Therefore the number of chromosomes in pollen grains is 7 or 8 as the next formulae indicate :—

$7 = 6a + M$, $8 = 6a + m_1 + m_2$ (a = autosome)

8) It is known that the female plants are more frequently met with than the males in the field. The chromosome number of root tips of 28 plants, whose sexes are not yet known, is determined as follows :—

Chromosome Number	14	15
Number of plants	25	3

9) In the 15-chromosomed plate, we see one large chromosome, while two large chromosomes are to be seen in 14-chromosomed ones. These large chromosomes show remarkable resemblance to the M chromosome in the male plant.

We are greatly interested in the problem, whether the 15-chromosomed plants are all males and the 14-chromosomed plants are all females, or not. Authors.

34. Cytological Studies on Rumex L. II. On the Relation of Chromosome Number and Sexes in Rumex Acetosa. L. (Japanese). Hitoshi KIHARA and Tomowo ONO. [Bot. Mag. Tôkyô **37** (1923), (147)-(149)].

The diploid chromosome number of *Rumex Acetosa* is 15 in the male plant and 14 in the female. The male plant has always one tripartite chromosome ($m_1 + M + m_2$) and six bivalent chromosomes in the first maturation division. The female has two M chromosomes and 12 autosomes in the somatic cells. The formulae of chromosomal elements are as follows :—

	Diploid	Haploid	(a=autosome)
♂	$12a + m_1 + M + m_2$	$6a + M$, $6a + m_1 + m_2$	
♀	$12a + M + M$	$6a + M$	

The tripartite chromosome in pollen mother-cells is therefore nothing other than the idiochromosomes complex, which has not so far been found in the higher plants ; M which forms the middle part of the tripartite chromosome is X-chromosome, while m_1 and m_2 represent together the Y-chromosome. Authors.

35. Beobachtungen über die verfaulten Zustande der im europäischen Stil gebauten Holzhäuser nach dem Erdbebenausbruch und der danach auf den verbrannten Bäumen entwickelten orangefarbigen Pilz. (Japanisch.) Kimizô KITASIMA. [Zeitsch f. Forstbauuntersuchungen. Spezialnr. (1923), 71-80, 1 Taf.]

Nach dem an 1. September 1923 stattgefundenen Erdbeben konnte der Verf. die Ruine vieler im europäischen Stil gebauten Holzhäuser genau beobachten. Wegen dieser Studien wurde er von der Tatsache überrascht, dass in den Gegenden von der grossen Luftfeuchkeit wie Japan wie schnell die Holzteile solcher Häuser ins Fäulniss übergehen. Besonders bei den mit Ziegelsteinen bedeckten Holzteilen hat der Verf. nicht selten das üppige Wachstum des Hausschwammmyzelien beobachten können, trotzdem die Holzteile nur noch einige Jahre alt sind, was offenbar der mit der höheren Temperatur verbundenen grossen Feuchtigkeit zu verdanken ist.

Einige Tage nach dem Feuer von 1. September hat man fast überall auf den verbrannten Bäumen die Entwickelung eines schönen orangefarbigen Schimmels wahrgenommen, welcher nach der Verf.'s Ansicht als *Monilia aurea* Gmel. zu betrachten ist, wenn auch inbezug auf diese Benennung die Resultate der Reinkultur einige Zweifel bei ihm entstehen lassen. Der in Rede stehende Pilz wächst ziemlich tief unter der Oberfläche des Wirtes. Die Konidienlager, welche

bald auf derselben erscheinen, sind zuerst weiss, dann schwach gelb und schliesslich orange. Die grosse Widerstandsfähigkeit des Pilzes gegen die Hitze wurde experimentell beobachtet. Danach bei 1/2 Stunde dauernder Erhitzung auf 55°C kann er ebenso schnell entwickeln wie der nicht besonders erwärmten, und bei gleiches Intervall währender Erhitzung auf 65°C wird seine Entwickelung nur etwas verzögert. Auf Grund von solchen Beobachtungen kommt der Verf. zum folgenden Schlusse: bei dem Feuerbrand sind alle Pilze zugrunde gegangen, ausgenommen nur dem oben genannten, welcher wegen seiner ausserordentlichen Widerstandsfähigkeit die Hitze ertragen konnte und somit bald zur reichlicher Entwickelung gekommen ist. (Vgl. auch Nr. 123.-Redaktion). Autoref.

36. Morphologie und Systematische Stellung des orangefarbigen Pilzes, welcher bald nach dem am 1. September 1923 in Tôkyô stattgefundenen Feuer entwickelt ist. (Japanisch.) Kimizô KITASIMA. [Zeit. d. forstwiss. Gesellsch. Japan **21** (1924), 285-291, 2 Textfiguren.]

Der Verf. hat weitere Studien über den in der vorhergehenden Nr. erwähnten orangefarbigen Pilz ausgeführt. Die ausführlichen Untersuchungen der Myzelien und Konidien des Pilzes haben die dort angedeutete Tatsache bestätigt, dass er als *Monilia aurea* Gmel. zu deuten ist. Indem der Verf. im wilden Zustande an den mit diesem Pilz infizierten Baumrinden usw. oft die Perithezien beobachtet hatte, hat er wiederholt die Reinkulturen dieses Pilzes aus den daraus isolierten Askosporen gemacht, wobei er die Produktion der charakteristischen orangefarbigen Konidien wahrnehmen konnte. Die Perithezien sind birnförmig und schwarz; jedes darin enthaltene Askus ist keulenförmig und enthält je acht Askosporen. Nach der Ansicht des Verf. muss der Pilz zu Sphaeriales gestellt werden, und zwar zu der Gattung *Anthostomella*. Auf Grund der obengenannten Resultate kommt der Verf. zum Schlusse, dass hierbei *Monilia* eine Konidien-Generation von *Anthostomella* darstellt, und nicht mehr immer als dieselbe von *Sclerotinia* zu betrachten ist, wie es bisher geschah. Autoref. (Vgl. Nr. 123.-Redaktion.)

37. Studies on the Acid Proof Staining Property of Cephalin. Ryokichi KOGANEI. [Jour. Biochem. Tôkyô **2** (1923), 495-503].

38. A preliminary Report on the Garden forms of Morus bombycis Koidz. (Japanese). Gen'iti KOIDZUMI. [Report Imp. Seric. Exp. St. Japan. **6** (1922), 14 pls., 40 figs.]

The author has investigated the numerous garden varieties or forms of *Morus bombycis* Koidz. as represented in the gardens of Japan. The taxonomic results are given for the 42 recognized forms. Author.

39. Synopsis Specierum Genus Mori. Gen'iti KOIDZUMI. [Bull. Imp. Seric. Exp. St. Japan. **2** (1923), 1-45, cum tabulis 11.]

The author has published a critical revision of the genus *Morus*, in Bot. Mag. Tokyo **31** (1917), 35-41. The present paper is a detailed iconograph of these accounts. In addition, 36 species are listed as imperfectly known, 31 species are excluded, and 21 new varieties or forms are described. Author.

40. Contributiones ad Cognitionem Florae Asiae Orientalis. Gen'iti KOIDZUMI. [Bot. Mag. Tokyo **37** (1923), 37-59.]

The author in continuation of his studies of the eastern Asiatic Flora, has described the following new species and new varieties. Anamtia is established as a new genus of Myrsinaceae from Japanese Hondo, related to the genus Rapanea.

Rhododendron tectum n. sp.

Coptis quinquefolia Miq. var. *pedatoquinquefolia* n. var.

Anamtia stolonifera n. gen. et sp.
Salvia japonica THUNB. var. *lutescens* n. var.
Salvia Fushimiana n. sp.
Salvia nipponica MIQ. subsp. *robusta* n. subsp.
Prunus kinkinensis n. sp.
Ilex stenophylla n. sp.
Spiraea ribisoidea n. sp.
Spiraea Kinashii n. sp.
Lactaria Nakaiana n. sp,
Lactaria Iwasakiana n. sp.
Poa ibukiana n. sp.
Primula Okamotoi n. sp.
Primula senanensis n. sp.
Fraxinus verecunda n. sp.
Aster sohayakiensis n. sp.
Ligularia telphusaeformis n. sp.
Euphrasia pubigera n. sp.
Kalopanax autumnalis n. sp.

The changes of the scientific names are as follows;

Menziesia tubiflora nom. nov. to *M. ciliicalyx* var. *tubiflora* KOIDZ.
Salvia nipponica f. *trisecta*, nom. nov. to *Salvia trisecta* MATSUM.
Prunus pudibunda KOIDZ. f. *antiqua*, nom. nov. to *P. antiqua* MIYOSHI.
Gentiana axillariflora LEVL. et VNT. var *Naitoana* nom. nov. to *G. Naitoana* LEVL. et VNT.
Gentiana axillariflora, var. *coreana*, nom. nov. to *G. jesoana* var. *coreana* NAKAI.
Rosa hakonensis nom. nov. to *R. Luciae* var. *hakonensis* FR. et SAV.
Lactaria acuminata nom. nov. to *Ochrosia acuminata* TRIMEN.
Lactaria glomerata nom. nov. to *Ochlosia glomerata* VALETON.
Lactaria borbonica nom. nov. to *Ochrosia borbonica* GMEL.
Lactaria Kilneri, nom. nov. to *Ochrosia Kilneri* MULLER.
Bleekeria (HASSK.) emend. div. sp. to *Ochrosia* div. sp.
Fraxinus commemoralis nom. nov. to *F. Spaethiana* LINGL. p. p.
Asteromoea pinnatifida nom. nov. to *Aster indicus* var. *pinnatifida* MAXIM.
Asteromoea incisa nom. nov. to *Aster incisus* FISCHER. And also the full synonymy of the following species are given.
Rosa multiflora THUNB. var *trichogyna* FR. et SAV.
Rosa Wichuraiana CREPIN.
Rosa fujisanensis MAKINO. Author.

41. Über die Bastardierung von Ricinus communis L. II. Mitteilung. Riichiro KÔKETSU. [Mitteil a. d. Mediz. Fakult. d. Kaiserl. Kyushu-Univ. **7** (1923), 401-419].

Die Vererbungsverhältnisse der Dornig- und Nichtdornigkeit der Fruchtkapseln von *Ricinus communis* wurde genauer als vorher studiert und wurde es konstatiert, dass die heterozygoten Pflanzen intermediäre Formen darstellen und folglich dass die Spaltungsformel in F_2 1 : 2 : 1 ist, was man schon durch aufmerksame Beobachtung, aber sicherer durch Zählung der Dornen bestätigen kann. Verfasser.

42. Über die Wirkungen der elektrischen Reizung an den pflanzlichen Gebilden. (Resumee Mitteilung). Riichiro KÔKETSU. [Bot. Mag., Tôkyô **36** (1922), 129-132].

Die wichtigsten Versuchsergebnisse dieser Arbeit sind hier vorläufig referatartig mitgeteilt. (Vgl. Nr. 43.-Redaktion). Verfasser.

43. Über die Wirkungen der elektrischen Reizung an den pflanzlichen Zellgebilden. Riichiro KÔKETSU. [Journ. Agric. Kyushu Imp. Univ. **1** (1923) 1–133, 40 Fig.].

Die elektrischen Reizwirkungen an den Pflanzen sind von verschiedentlichen Seiten studiert, insbesondere mit Berücksichtigung auf die allgemeine Reizphysiologie. Als Reizmittel wurden sowohl der knostante Strom als auch der Induktionsstrom gebraucht, und das *Mimosa*-Blattgelenk, die *Mazus*-Narbe, die *Cissus*-Ranke und das strömende *Chara*- und *Tradescantia*-Plasma usw. als Versuchsmaterial. Die Hauptpunkte der Ergebnisse sind:

1. Die Formänderung des Plasmas und der Gewebe, welche durch die elektrische Reizung zustande kommen, sind als Kontraktionserscheinungen aufzufassen, wie es beim Muskel der Fall ist.

2. Der zeitliche Verlauf der Reaktion an den elektrisch gereizten pflanzlichen Gebilden ist ähnlich demjenigen bei den tierischen. Nämlich, je grösser die Stromstärke, desto kürzer ist das Latenzstadium und der aufsteigende Reaktionsschenkel, dagegen desto länger der absteigende.

3. An den untersuchten Objekten pflegt der Oeffnungsinduktionsstrom stärker zu wirken, als der Schliessungsinduktionsstrom. Die Reaktionsgrösse an dem strömenden Plasma und an der Ranke ist abhängig von der Reizintensität. Dagegen gilt das Alles-oder-Nichtsgesetz für *Mimosa*-Gelenk und *Mazus*-Narbe.

4 Die relative rasche Verstärkung oder Verminderung des konstanten Stromes wirkt erregend, wie die plötzliche Schliessung oder Oeffnung desselben. Bei schwächerem Strom bleibt das „Ein- und Ausschleichen" reaktionslos, während es bei stärkerem Strom nur schwer möglich ist.

5. Um eine Erregung zu erreichen, sind einerseits eine bestimmte minimale Dauer des Reizstromes (Präsentationszeit) und andererseits eine bestimmte minimale Reizstärke (Reizschwelle) nötig, und zwar pflegt die erstere umso kleiner zu sein, je stärker die Stromstärke.

6. Die Summation unterschwelliger Reize ist leicht konstatierbar. Sie geschieht desto leichter, je kürzer das Reizintervall und je stärker der Strom ist. Die Summierung der zwei wirksamen Reize und die „Tetanus"-artige Reaktion bei der Wiederholung wirksamer Reize kommen an dem strömenden Plasma und der Ranke vor, aber nicht an *Mazus*-Narbe und *Mimosa*-Gelenk.

7. Bei langsamer elektrischer Reizung wird die Erregbarkeit zunächst erhöht und dann durch Ermüdung herabgesetzt. Die Erregbarkeitserniedrigung während der Reizung und nach Behandlung mit Narkotika ist auch klar gemacht.

8. Das Gesetz der polaren Erregung gilt für alle untersuchte Objekte; Anodenschliessungs- und Kathodenöffnungsreaktion, welche bei stärkerer Reizung zustande kommen, sind nichts anderes als die Kathodenschliessungs- bzw. Anodenöffnungsreaktion an den virtuellen Polen. Aber bei sehr starkem Strom kommt eine Anodenschliessungsreaktion vor, welche aber als eine Schädigung an der Anode betrachtet wird. Hemmende polare Wirkungen und elektrotonische Erscheinungen sind auch an den pflanzlichen Gebilden nachweisbar.

9. Der Galvanotropismus der Keimwurzeln ist gründlich durch die anodenseitigen Schädigung verursacht. Die Galvanotaxis der frei beweglichen Organismen scheint aber wenigstens bei schwächerem Strom eine echte Reizbewegung zu sein.

10. Die innere Polarisation bei Durchströmung ist an den pflanzlichen Zellgebilden nicht nur von der Plasmahaut, sondern auch von der Zellhaut bedingt. Der gereizte oder verletzte Teil des pflanzlichen Gewebes ist stets elektronegativ gegen den ungereizten bzw. normalen.

Autoref.

44. On the Biochemical Study of the Ripening of the Kaki-Fruit. I-II. Shigeru KOMATSU and Hidenosuke UEDA. [Jour. Biochem. Tokyo **1** (1922), 181-194, **2** (1923) 291-300.]

45. On the Biochemical Study of the Ripening of the Kaki-Fruit. III, IV, V. Shigeru KOMATSU and Motaro ISHIMASA. [Jour. Biochem. Tokyo **2** (1922), 301-308, 309-313; **3** (1924), 261-272.]

46. Studies in the Effect of Röntgen Rays upon the Development of Vicia faba. Hideo KOMURO. [Jour. Coll. Agr., Imp. Univ. Tôkyô, **8** (1923), 253-292, 2 pls.]

In my experiment on the effect of RÖNTGEN rays published in 1921 I have raised seeds of "Sengoku-kurome" and "Hyôgo" races of *Vicia faba* and used GIBA gas tube (platinum anticathode). In 1922 I have used seeds of another kind of *Vicia faba*, called "Wase-soramame", and X-ray tube, ÔKURA gas tube with tungsten anticathode, using the water cell of aluminium to prevent the thermal factor entering into the experimentation, and I was able to confirm the previous statements. One of these experiments is described in this paper. Most important and new facts gained from the author's experiments were as follows: Though the seeds are exposed to RÖNTGEN rays of high dose, their development does not stop immediately, for they germinate and develop for a certain period. Sprouts from irradiated steeped seeds containing much water do not appear above the soil, and the injured plants cease to develop at almost the same stage of growth under the ground. There is no difference in growth proportional to the doses given (when the steeped seeds contain the same amount of water by steeping). When the dose of RÖNTGEN rays exceeds a certain limit, it does not induce a visible difference in the state of impediment proportional to the dose. The effect of RÖNTGEN rays in these cases is no more than an injurious stimulation for the seeds; of course, this limit varies with the water contents of the seeds at the time of irradiation.

From these facts, the writer thinks it may be presumed that strongly irradiated seeds are particularly affected at the plumule and radicle, and metabolic change of these parts may take place (the cytological changes in radicles resembling those of tumor cells), and when this change reaches a certain stage the seedlings cease to develop. Author.

47. Studies in the Effect of Röntgen Rays upon the Germination of Oryza sativa. [Bot. Mag. Tôkyô **38** (1924), 1-20, 4 figs. in text.]

The results of experiments may be summed up in following statements:

1. The germination of air-dried seeds and of steeped seeds was accelerated by the irradiation of X-rays.

2. The acceleration of germination is obviously shown in the seeds X-rayed in the air-dried condition, and the dose of 5 H—10 H seemed to be an optimum. 10 H especially showed an evident acceleration of germination.

3. In the further growth after germination, plants grown from the seeds irradiated after 12 hours' steeping were worse than plants grown from the seeds X-rayed in the air-dried condition. In the latter case, between the state of growth of the controls and that of X-rayed material there appeared no great difference. But in the former case the irradiated showed the better growth in an earlier stage.

4. In the case of steeped-irradiated material, 15 H seedlings generally grew well. The 5 H, 7 H and 10 H seedlings were poorer in growth that the controls at the time of germination, but in the further growth stages surpassed them.

5. The acceleration of germination varies with the current (in the case of the same material and the same hour of exposure) and the hour of irradiation (in the case of the same material and under the same current) in a definite tube. Author.

48. Beiträge zur Kenntnis der Keimungsphysiologie der Reissaatkörner (Oryza sativa), des Wachstums ihrer Keimpflanzen und der Beschaffenheit des Reissaatbeetes. Mantarô KONDÔ. [Ber. Ôhara Inst. landw. Forsch. Kuraschiki, **2** (1923) 291-359, 20 Figuren].

Der Verfasser hat seit dem Jahre 1916 über 1) das Einweichen der Reissaatkörner vor dem Säen, 2) die Keimung der Reissaatkörner und das weitere Wachstum ihrer Keimpflanzen auf dem Saatbeete und 3) die Temperatur der verschiedenen Reissaatbeete untersucht und folgende Ergebnisse bekommen.

I. Die für das Einweichen der Reiskörner vor dem Aussäen geeignetste Zeit ist bisher durch die zur Wassersättigung nötige Zeit festgestellt worden. Es muss aber die zur Keimförderung erforderliche Zeit bezw. durch die mittlere Keimdauer bei verschiedenen Temperaturen ermittelt werden. Dann ist die Einweichzeit bei niedrigen Temperaturen grösser als die zur Wassersättigung nötige Zeit, bei höheren Temperaturen dagegen ist es umgekehrt.

II. Die Ansicht, dass ungenügend reife Reiskörner zur Saat geeigneter sein als vollreife ist falsch. Die Vollreife ist ja die geeignetste Erntezeit für die Reissaatkörner, weil die vollreifen Körner ausgezeichnet keimen und ihre Keimpflanzen auch gut weiter wachsen. Die ungenügend reifen Körner sind als Saatkorn unbrauchbar, weil nur wenig keimen und ihre Keimpflanzen schwach und langsam weiter wachsen. Die todreifen Körner stehen den vollreifen Körnern in jeder Beziehung nach.

III. In wärmeren oder heissen Gegenden oder Jahreszeiten darf man die Saatbeete nicht zu hoch mit Wasser bedecken, sondern sie nur ein wenig bewässern oder gar nur in wassergesättigtem Zustande halten. Zuviel Wasser beeinflusst die Keimung und das Wachstum der Reiskörner nachteilig. In kalten Gegenden und Jahreszeiten dagegen ist es notwendig, die Saatbeete Tag und Nacht über mit Wasser zu bedecken, vor allem um sie warm zu erhalten.

IV. Im Wasserbeete wächst das Hälmchen des Reiskornes viel schneller als in dem nur seicht mit Wasser bedeckten oder in dem nur wassergesättigten. Die Hälmchen sind lang aber dünn. Bei geringerer Bewässerung wächst das Hälmchen verhältnismässig langsamer. Es bleibt kurzer, wird jedoch dicker.

V. Das Würzelchen dagegen wächst in den Beeten mit viel Wasser langsam und bleibt verhältnismässig kurz. In den nur wassergesättigten Beeten aber wächst das Würzelchen sehr schnell und wird sehr lang. Das Verhältnis zwischen Würzelchen und Wassermenge ist also umgekehrt wie das zwischen Hälmchen und Wassermenge. Wenn es aber nicht genügend warm ist, so wächst das Würzelchen nur in tiefen Wasser gut, bei wenig Wasser dagegen verkümmert es oder wächst gar nicht.

VI. Die Entwässerung der Reissaatbeete bei Tage und die Bewässerung bei Nacht ist immer zwecklos, und oft sogar nachteilig. Wenn es genügend warm ist, so genügt es die Beete Tag und Nacht über im wassergesättigten Zustande zu halten. Solange es noch kalt ist, empfehlt es sich die Beete stets mit Wasser bedeckt zu halten.

VII. Das Bedecken mit Flussand, Kompost, gebrannten Reiskornhülsen beeinträchtigen die Keimung der Reiskörner und das weitere Wachstum der Keimpflanzen. Es setzt die Saatbeet-Temperatur stets herab.

VIII. Das Keimtrocknen, welches nach der Keimung bei Wasserbeete gemacht wird, ist für das Wachstum des Pflänzchens durchaus nicht vorteilhaft, sondern nachteilig.

IX. In der Nähe der Küste ist der Boden oft alkalisch und reich an Salz. In diesem Falle muss man naturlich die Beete immer gut mit Wasser bedecken. Zu wenig Wasser ist sehr schädlich. Bei nicht zu starkem Salzgehalt ist es aber zweckmässig, die Beete nur in wassergesättigtem Zustande zu halten und mit schwarz gebrannten Reiskornhülsen zu bedecken.

Siehe auch „Japan. Jour. Bot." **1** (1922-3) Abstracts Nr. 13 und 98. Verfasser.

49. Über die Korrelationen zwischen den quantitativen Eigenschaften der Elitepflanzen des Reises, Weizens und der Gerste und denselben Eigenschaften ihrer Nachkommenschaften. (Japanisch). Mantarô KONDÔ und Yasukitu NOGUTI [Jour. Sc. Agr. Soc. **242** (1922) 947-962].

Es besitzt unstreitig ein ganz praktisches Interesse der Pflanzenzüchtung zu untersuchen, in welcher Weise die verschiedenen quantitativen Eigenschaften der Elitepflanzen zur Nachkommenschaften sich vererben. Die Verfasser haben diese Frage bei Reis, Weizen und Gerste untersucht. Zuerst haben sie mehrere Elitepflanzen mit verschiedenen Eigenschaften ausgewählt, welche auf dem Felde in so gleicher Bedingungen wie möglich gebaut worden sind. Im nächsten Jahre wurde jede Elite zu je 200 bezw. 150 Nachkommenschaften vermehrt. Bei den Elitepflanzen wurden 1) Gesammtpflanzengewicht, 2) Strohgewicht, 3) Halmzahl, 4) Halmlänge 5) Gesammtkorngewicht, 6) Kornzahl einer Rispen bezw. Ähre, 7) Prozent des Korngewichtes zum Gesammtpflanzengewichte, 8) Prozent des Spelzengewichts zum Korngewichte des Reises, 9) Tausendkorngewicht, und 10) Korndichte der Ähre untersucht. Bei den Nachkommenschaften wurden die oben angegebenen Eigenschaften wieder untersucht. Darauf haben die Verfasser die Korrelationskoeffizienten dieser quantitativen Eigenschaften zwischen der Elite und Nachkommenschaft berechnet. Diese Feldversuche dauerten vom Jahre 1914 zum Jahre 1917. 8 Sorten des Reises, 3 Sorten des Weizens und 3 Sorten der Gerste sind gebraucht worden. Diese Ergebnisse sind die folgenden:—

I. Es gibt eine positive Korrelation zwischen der Elite und ihren Nachkommenschaften in den folgenden Eigenschaften.

1) Kornzahl einer Ähre bezw. Rispe, 2) Korndichte der Ähre, 3) Tausendkorngewicht, und 4) Halmlänge. Diese Eigenschaften der Elite also vererben sich zur Nachkommenschaft sicher.

II. Es gibt aber gar keine bestimmte Korrelationsverhältnisse in den folgenden Eigenschaften.

1) Halmzahl, 2) Gesammtpflanzengewicht, 3) Gesammtkorngewicht, 4) Strohgewicht, 5) Prozent des Korngewichtes zum Gesammtpflanzengewichte, und 6) Prozent des Spelzengewichtes zum Korngewichte des Reises.

Man kann also nicht sagen, dass diese Eigenschaften der Elitepflanzen zur Nachkommenschaften immer sich vererben können.

III. Bei der Auslese der Elite ist es sehr zweckmässig, die Eigenschaften der Ähre bezw. Rispe und Kornbeschaffenheiten zu beachten. Die Halmzahl und das Gesammtkorngewicht der Elite hingegend dürfen nicht zu viel beachtet werden.

Die Verfasser haben auch noch die Korrelationen zwischen 12 verschiedenen Eigenschaften der Elitepflanzen des Reises und dem Kornertrage der Nachkommenschaft genau untersucht und gefunden, dass immer gar keine bestimmte Korrelationsverhältnisse vorhanden sind. Es ist also nicht möglich, durch ein bestimmtes Merkmal eine gute Elitepflanze auszuwählen, deren Nachkommenschaft sehr ertragreich ist. Verfasser.

50. Über eine Art von Semisterilität beim Reise. (Japanisch). Mantarô KONDÔ und Mamoru ONO. [Nôgaku Kwaihô (Jour. Sc. Agri. Soc.) **250** (1923), 589-598, 2 Abbild.]

Im Jahre 1916 kam ins Versuchsfelde des Ôhara-Instituts, bei der Züchtung einer reinen Linie von „Sinriki" eine semisterile Reispflanze unerwartet zum Vorschein. Die Verfasser haben diese Pflanze von 1916 bis 1922 in Pedigree gezüchtet und vermehrt und ihre verschiedenen Eigenschaften untersucht. Diese Pflanze hat starke Halme, grosse Körner und lockere und begrannte Rispen. Bei der jährlichen Vermehrung haben die Verfasser stets gefunden, dass die gesamte Nachkommenschaft semisteril war, und dass keine normale Fertilpflanze zum Vorschein kam. Bisher war bekannt, dass semisterile Reispflanzen heterozygotisch sind, und

sich in ihrer Nachkommenschaft in Semisteril- und Fertilpflanzen spalten. Die betreffenden semisterilen Reispflanzen aber sind homozygotisch und ganz anders als die bekannten semisterilen Reispflanzen. Die Prozentzahl der Sterilität der unbefruchteten Blüten der Pflanze betrug 1917 63%, 1918 61%, 1919 65%, 1920 65%, 1921 75%, und 1922 81%; im Durchschnitte also 67%. Der Prozentsatz ist also sehr hoch. Bei gut bekannten semisterilen Reispflanzen machen die Sterilitätsblüten weniger als 50% aus. Die Verfasser haben auch versucht, die Verteilung der unbefruchteten Blüten in einer Rispe zu untersuchen. Die Herstellung der Analysenbildern von Rispen ist ohne Zweifel am besten geeignet, den Rispenbau klar zu machen, doch ist diese Arbeit sehr zeitraubend. Sie haben die Rispen analysiert und 92 Rispenbilder hergestellt. Aus den Rispenbildern haben die Verfasser die Verteilung der unbefruchteten Blüten in den Rispen untersucht. Es fragt sich zunächst, ob die Befruchtung der Blüten von unten bis zur Spitze der Rispen gleichmässig verteilt ist oder ob irgendwo taube Felder festzustellen sind. Die Verfasser haben gefunden, dass die unbefruchteten Blüten im oberen, mittleren und unteren Drittel der Rispen und in den Primärzweigen wie in den Sekundärzweigen stets gleichmässig verteilt sind, dass also keine besondere Zone unbefruchteter Blüten vorhanden ist. Die Anzahl der unbefruchteten Blüten ist aber in den Sekundärzweigen wahrscheinlich etwas grösser als in den Primärzweigen. Die Verfasser haben auch den Punkt untersucht, ob die Häufigkeit der Sterilität entsprechend der Halmlänge (bezw. nach der Reihe der Halmbildung) verschieden ist, aber in dieser Beziehung keinen Unterschied feststellen können. Autoren.

51. On the Temperature of Rice in the Straw-bag. (Japanese). Mantarô KONDÔ and Motoharu TAKEDA [Ryôsyoku Kenkyû (Food Researches) **19** (1923), 1–17].

Since the temperature of rice is a very important problem in rice-storage in Japan, the writers made a study of the question from 1916 to 1922, using the several kinds of hulled rice (Genmai). The rice was stored in a granary of the Ôhara-Institute.

The following results were obtained.

1) The temperature of rice grains in a straw-bag varies with the air temperature of the granary, according to the season. In summer the rice temperature is of course highest and in winter lowest.

2) There is little variation in the course of a day; rather, it is almost constant, but the temperature of the granary varies greatly in this time, just as the air temperature out of door. The temperature of rice in the granary is, therefore, in the course of any one day not always equal to that of the granary itself.

3) The rice temperature is always different from the granary temperature. Generally, the former is higher than the latter in summer and autumn; and especially in September and October the temperature difference is very great; in winter and spring, on the contrary, the former is lower than the latter and in January and February the difference in the respective temperatures is very great.

4) The temperature of unhulled grains (Momimai) in straw-bags is in summer and autumn a little lower than that of hulled grains (Genmai).

5) If the water content of rice grains is large, then the rice temperature is high. This is in summer and autumn especially noticeable, but not in winter.

6) Several kinds of insects in rice straw-bags, which in summer are very numerous, raise the rice temperature considerably.

7) It is important to open the doors of a granary, when the outdoor air is cooler and drier than the granary air, but to keep them shut, when the contrary is the case. Authors.

52. On the Variation in the Water Content of Rice Grains in Straw-bags during Storage. (Japanese). Mantarô KONDÔ and Motoharu TAKEDA. [Ryôsyoku Kenkyû (Food Researches) **20** (1923), 1–14.]

From 1915 to 1922 the writers have stored several kinds of hulled rice grain (Genmai) in straw-bags, in a granary of the Ôhara-Institute at Kurashiki and studied the variation in the water content of rice grains during the time of storage. The following results were obtained;

1) The water content of rice grains in straw-bags in a granary decreases gradually during the years that they are stored.

2) According to the season, the water content of rice grains varies greatly; in June and July it is greatest, and in December and January least, since it is greatly affected by the atmospheric humidity.

3) If various kinds of rice grains of different water content are stored together, it will be seen that their water content gradually changes approaching to each other and finally almost coinciding, but after several years the rice grains lose water gradually and become dry. In this case it is observable that those rice grains, that were in the beginning most dry lose most water. At last the water content of rice grains becomes very different according to the degree of dryness of the grains in the beginning.

4) The writers found no special difference in the variation of water content between different qualities of rice grains or between hulled (Genmai) and unhulled rice grains (Momimai). Authors.

53. On the Variation in the Water Absorbing Capacity and the Swelling Ability in Water of Rice Grains Stored Several Years in Straw-bags. (Japanese) Mantarô KONDÔ and Motoharu TAKEDA. [Ryôshoku Kenkyû **21** (1923), 1-21].

From 1915 to 1922 the writers stored several kinds of hulled rice grains (Genmai) in straw-bags in a granary of the Ôhara-Institute. In the experiments they took the rice grains of 50 g from every bag and soaked them in water of 25-28° C for 48 hours. It is a matter of course that the rice grains then increase greatly in volume and weight. The writers carried on the experiments every month during the time of storage and found that the percentage of increase in weight (=water absorbing capacity) and volume (=swelling ability in water) is variable according to the length of storage, as the following results will show.

1) The water absorbing capacity and swelling ability in water of rice grains, which are stored in straw-bags, decrease regularly with the length of storage.

2) Let x be the number of months, during which the rice grains are stored, let y be the percentages of increase in volume or weight and let a and n be constants, then there will result the following equation: $y = ax^n$.

3) By experiments and calculations the constants a and n can be determined. Take any hulled grains in storage. If the percentages of increase in volume or weight of grains in water are investigated, then the number of months of storage of the rice grains can be easily found by the equation.

4) When rice grains are soaked in water, the percentages of increase in volume are much greater than those in weight.

5) The water content of rice grains has an effect upon the water absorbing capacity and swelling ability, but this effect is much fainter than that caused by the length of storage.

6) Notwithstanding the seasonal variation in the water content of the grains, the water absorbing capacity and the swelling ability of water-soaked rice grains varies only in the least degree with the season. Authors.

54. The Labiates of Hokkaido. Yûshun KUDÔ. [Japan. Jour. Bot. **1** (1922), 87-91, 1 Table and 1 Fig.]

55. A Contribution to our Knowledge of the Flora of Northern Saghalien.

Yûshun KUDÔ. [Jour. Coll. Agric., Hokkaido Imp. Univ., Sapporo, **12** (1923), 1-68, 12 pls.]

The article contains results of the study of plants of Northern Saghalien, engaged by the writer in the summer of 1922. A description of the trip is given with special references to the vegetation of the district. Types of vegetation are recorded and illustrated by 12 plates. A list is presented of 402 species, distributed among 211 genera and 67 families. Locality and habitat are given for each species. The following new names and combinations are proposed: *Polygonum frigidum* KUDO, *Polygonum polymorphum* LEDEB. var. *ajanense* RGL. et TIL. form. *divaricatum* KUDO, *Cerastium caespitosum* GILIB. var. *glandulosum* KUDO, *Pulsatilla Tatewakii* KUDO, *Sedum pluricaule* KUDO, *Sorbus commixta* HEDL. var. *Takasui* KUDO, *Inula britannica* L. var. *tymiensis* KUDO, *Artemisia sacrorum* LEDEB. var. *angustiloba* KUDO, *Crepis Tatewakii* KUDO, *Scorzonera radiata* FISCH. var. *humilis* MIYABE et KUDO. Author.

56. On the Colouring Matter of Lithospermum Erythorhizon. Riko MAJIMA and Chika KURODA. [Acta Phytochem. **1** (1922), 43-65.]

57. Further Studies on Physiology of Rhizoctonia Solani Kühn. Takashi MATSUMOTO. [Bull. Imp. Col. Agr. For. Morioka. No. **5** (1923), 1-64, 3 fig., 1 pl.]

The present paper is to serve as a supplementary report by showing to what extent a single strain can exhibit specialization in physiological behaviors under the influence of changes in the culture media or other several environmental conditions, at the same time by presenting some additional data concerning the physiological characteristics of the fungus in question. The penetration of cell wall, as well as cuticle, by *Rhizoctonia* might not be brought about by mechanical pressure alone, but at the same time be assisted by the enzymes or other related substances liberated from the invading hyphae. Effect of H-ion concentration on the growth of the strains and the activity of some enzymes were comparatively studied. Secretion of pectinase by the fungus was microscopically as well as chemically confirmed. Cultural experiments with special reference to the relationships subsisting between nitrogen and carbon requirements of the strains were performed to a certain extent. The hyphal growth and enzyme activity may be more or less retarded by an addition of tannin even at a relatively slight degree of concentration excepting a few cases. The growing hyphae secrete toxic substance which is injurious to the mycelial growth. Fusion of hyphae takes place more frequently between the hyphae from strains which have been isolated from the same species of host. Physiological characteristics of *Rhizoctonia* may be more or less modified by a transfer to host, or certain environment.

58. Preliminary Communication on Mannanase and Lävudulinase. Minoru MAYEDA. [Jour. Biochem. **1** (1922), 131-137.]

59. On the Number of Seeds in the Fruits of Citrus nobilis Lour. var. unshiu Swingle. (Japanese). Taidi MIKI. [Idengaku Zassi (Japan. Jour. Genetics) **1** (1922), 173-184.]

Citrus nobilis var. *unshiu* produces only a small quantity of pollen with very weak germinating power or often no pollen at all, and consequently fruits of parthenocarpous origin are generally produced. But as pistils are partially fertile, some seeds are often produced. In order to study the variation in the number of seeds in this variety the author has cultivated it in a garden, together with a number of seed-producing *Citrus* species or varieties; besides he has performed its artificial crosses with pollen of the latter. As the results of a number of observations he has found in the former 1-10 seeds for each fruit, their average number per fruit being 1.028. In the case of artificial pollination the number of seeds is considerably larger than in the former case: their number is 0-13 for each fruit and 3.610 per fruit in average. Author.

60. Icones of the Essential Forest Trees of Hokkaido. Kingo MIYABE and Yûshun

KUDÔ. Fasc. **9-10** (1923), Tokyo. 6 colored plates, 22 pp. Explanations in English and Japanese.

Fasc. **9** contains *Betula Ermani* Cham., *Betula japonica* Sieb. and *Alnus japonica* Sieb. et Zucc. var. *arguta* Call.

Fasc. **10** contains *Alnus hirsuta* Turcz., *Alnus Maximowiczii* Call. and *Alnus pendula* Matsum. Authors.

61. On a Brown Shot Hole Disease of Cherry Leaves Caused by Mycosphaerella cerasella Aderh. (Japanese.) Chûichi MIYAKE. [Ann. Phytopatholog. Soc. I. 5 (1923), 31–42, 1 pl.]

(1) The present paper deals with the brown shot hole disease of cherry leaves caused by *Mycosphaerella cerasella* ADERH., which is known as the ascigenous stage of *Cercospora cerasella* SACC.

(2) Investigations on the causal organism were carried out chiefly on the morphological characters of its conidiophore, conidium, perithecium, ascus and ascospore by the writer under the directions of Mr. Y. NISIKADO, Plant Pathologist of the Ôhara Institute.

(3) This disease is not only common in *Prunus cerasus*, but also in *Prunus Yamasakura* var. *typica*, *Prunus Yamasakura* var. *spontanea* subvar. *hortensis*, *P. Itosakura* and *P. Itosakura* var. *subhirtella* in the western parts of Japan.

(4) The genetic relation of *Cercospora cerasella* SACC. and *Mycosphaerella cerasella* ADERH. has been demonstrated by comparative cultural studies of the isolations secured from both ascigenous and conidial stages.

(5) The parasitic nature of the present fungus has been ascertaind by successful inoculations carried out on above described five varieties of the cherry (*Prunus* spp.) Author.

62. Genetic Studies in the Opium Poppy (Papaver somniferum L.) I. On the Flower-color. (Japanese). Kiichi MIYAKE and Yoshitaka IMAI. [Bot Mag. Tôkyô **37** (1923), (1)-(13), 1 fig.]

The present paper deals with the genetics of the flower-color in the opium poppy. The chief results obtained are as follows:

I. The allelomorphs investigated are the following five:

R, r—In the presence of the subsequent **D** factor, **R** is responsible for the red flower, and its recessive mate, **r**, represents purple flower. The flower color of the hybrid is dark red, being almost intermediate of both homozygotes.

D, d—These allelomorphs are responsible for the eye color of the flower, i. e., either purple or white. The **R** factor working with double **d** produces red flower with white center, but the flower remains colorless in its double recessive combination.

I, i—This dominant factor changes white centred red flower into white, acting as an inhibitor to the colored.

S, s—The former is responsible for producing the "Sakura" flower, and the **s s**-composition represents a recessive white flower.

H, h—The dominant factor acts as an inhibitor to "Sakura," changing the flower color into white.

II. There are two kinds of white flower, i.e., the dominant and the recessive to every white centred red and "Sakura" flowers.

III. A linkage of high intensity was found between **r** and **i** factors. Authors

63. On the Genetic Behavior of Some Factors in Aduki-Bean. (Japanese.) Kiichi MIYAKE, Yoshitaka IMAI and Kiyoo TABUCHI. [Bot. Mag. Tôkyô **38** (1924), (1)-(9).]

Among crosses, colored stem × green one, a mating gave a mixed F2 generation consisting

of 9 coloreds and 7 greens in every 16. The reason why we have not usual 3 : 1 ratio, but 9 : 7, may be readily explained by the interaction of two complementary factors. The assumption was confirmed by the results obtained in F_3 and F_4.

The parents of this cross also differed in the color pattern of seed-coat, the one being self black and the other red eyed white. The F_2 generation raised from the self black seeded hybrids consisted of four different types, self black, self red, red eyed white with black mottling on the colored part and red eyed white, in 9 : 3 : 3 : 1 ratio. The subsequent breeding test proved that the segregation was the result of the recombination of two factors which are responsible for the particular color pattern on the seed-coat.

There is found the complete correlation between the stem color and the seed pattern. Thus all colored stems gave only self black seeds, while all green stems gave either one of the remaining three. This interesting fact may be explained by assuming the occurrence of two strong linkages between the factors for stem color and seed pattern. An alternative explanation may also be suggested, which assumes the multiple effects of the factors of the stem color or those of the seed pattern. Authors.

64. Chemische Untersuchungen über Widerstandsfähigkeit der Reisarten gegen die „Imochi-Krankheit." Erster Bericht. Vergleich der hauptsächlichsten chemischen Bestandteile von vorläufig zwei in Hokkaido angebauten Reisarten, einer empfänglichen und einer widerstandsfähigen. Koji MIYAKE und Masashi ADACHI. [Jour. Biochem. Tokyo **1** (1922), 223-239.]

The investigation was made on two varieties of rice "Akage" and "Bozu", the former being susceptible and the latter comparatively resistant to the disease caused by the "Imochi-fungus". Of both varieties the chief chemical compositions were analysed at 3 different periods of growth for the basis of further studies. And it was found that a larger amount of sugar, protein, MgO, K_2O and P_2O_5 is contained in "Akage" than in "Bozu", while the latter is richer in silica. In both varieties the nodes were found to be richer in sugar, protein, MgO, K_2O and P_2O_5 than the internodes, while these contain a larger amount of silica. In the leaves of "Akage" also more sugar protein, MgO, K_2O and P_2O_5 was found than in those of "Bozu". On the contrary, the quantity of silica in the leaves was larger in the case of "Bozu" than in that of "Akage". Authors.

65. Chemische Untersuchungen über die Widerstandsfähigkeit der Reisarten gegen die „Imochi-Krankheit." Zweiter Bericht. Der Einfluss der Wasserstoffionenkonzentration auf das Wachstum des Pilzes. Koji MIYAKE und Masashi ADACHI. [Jour. Biochem. Tokyo **1** (1922), 241-247.]

Experiments were made to determine the growth capacity of the "Imochi-fungus" in media with different P_H values prepared by the addition of 4 kinds of acid. The H-ion concentration to inhibit the growth of the fungus was found to be $P_H = 3.1$. In the concentrations between $P_H = 3.1$ and 3.7 the growth of the fungus was scarcely noticeable while in the concentrations above 3.7 its growth gradually increased according to the rise of the P_H value. Authors.

66. Chemical Studies of Corn Pollen. I. Isolation of Phytosterol and Inosite. Suguru MIYAKE. [Jour. Biochem. Tokyo **2** (1922), 27-32.]

67. Chemical Studies of Corn Pollen. II. Carbohydrates and Organic Bases. Suguru MIYAKE. [Jour. Biochem. Tokyo **3** (1924), 169-176.]

68. Genetische Studien über die Samenfarbe bei dem japanischen Convolvulus. (Japanisch). Bungo MIYAZAWA. [Idengaku Zassi (Japan. Zeits. Vererbungsl.) **2** (1923), 1-11].

I. Kreuzung :—(Bl. =Blütenfarbe, Sa.=Samenschalefarbe)

	Sippe	Bl.	Sa.
P	A	weiss	weiss
	B	blau	braun
F_1 = A×B		schwach blau	schwarz

F_2 ... Bl. blau, Sa. schwarz : Bl. blau, Sa. braun : Bl. weiss, Sa. weiss = 9 : 3 : 4. Deutung : A-Sippe = **RRccnnKK**, B-Sippe = **RRCCNNkk**. **R** + **C** für Blütenfarbe, einzeln wirkungslos ; **K** + **N** für schwarze Samenschale, **K** allein wirkungslos, **N** allein für braune Samenschale ; **C** und **N** absolut verkoppelt. F_3 -Kultur ausgeführt.

II. Kreuzung :—

	Sippe	Bl.	Sa.
P	B	blau	braun
	C	weiss (etwas gelblich, Tubus spurweise rötlich	schwarz
F_1		blau	schwarz

F_2...Bl. blau, Sa. schwarz : Bl. blau, Sa. braun : Bl. weiss, Sa. schwarz : Bl. weiss, Sa. braun = 9 : 3 : 3 : 1.

Deutung : B-Sippe = $R_1R_1R_2R_2$CCNNkk

C-Sippe $R_1R_1r_2r_2$CCNNKK

C, N, K wie bei I. Kreuzung. R_1 + C verursacht die blaue Farbe des Blütentubus, R_2 + **C** dieselbe aller anderen Blütenteilen. F_3-Kultur ausgeführt.

III. Kreuzung :—

	Sippe	Bl.	Sa.
P	A	weiss	weiss
	D	scharlachrot	schwarz
F_1 = (A×D u. D×A)		blau	schwarz

F_2 ... Bl. blau, Sa. schwarz : Bl. u. Sa. weiss = 3 : 1

Deutung : A-Sippe = **RRccnnKK**, D-Sippe = **RRCCNNKK**

IV. Kreuzung :—

	Sippe	Bl.	Sa.
P	A	weiss	weiss
	E	weiss, etwas gelblich	schwarz
F_1 = (E × A)		blau	schwarz

F_2 ... Bl. blau, Sa. schwarz : Bl. weiss, Sa. schwarz : Bl. weiss, Sa. weiss = 9 : 3 : 4.

Deutung : A-Sippe = **RRccnnKK**

E-Sippe = **rr**CCNNKK

F_3 — Kultur ausgeführt.

In einem Falle hat der Verf. den Gerenaustausch von **C** und **N** beobachtet, die sonst absolut verkoppelt sind.

V. Kreuzung :—Die Pflanze mit schwarzgestreifter Samenschale hat immer bunte Blätter. Bei ihrer Kreuzung mit normalen Pflanzen haben die F_1- Pflanzen grüne Blätter : in F_2 sind die Nachkommen grün und bunt und die letzteren haben immer gestreifte Samen, was an die absoluten Verkoppelung der bunten Blätter und der gestreiften Samen erinnert.

Weiter hat der Verf. die Beobachtung gemacht, dass die gefärbten Samenschalen mit kurzen weichen Haaren versehen sind, während die weissen fast haarlos sind. Verf.

69. A Bacterial Rot Disease of Saffrons. Yoshijirô MIZUSAWA. [Ann. Phytopathol. Soc. Japan. **I**.5 (1923), 1-12.]

See Japan. Jour. Bot. **1** (1922), Abstract, No. 24.

Entry 69

70. Notes on the Species Hybrids in the Genus Mosla. Isaburo NAGAI. [Japan. Jour. Bot. **1** (1923), 93-104, 2 pls. and 4 figs.]

71. Observations on the Somatic Segregation in Soy Beans. Isaburo NAGAI. [Japan. Jour. Bot. **2** (1924), 63-70.]

72. Linked Factors in Soy Bean. Isaburo NAGAI and Shuichi SAITO. [Japan. Jour. Bot. **1** (1923), 121-136].

73. Notulae ad Plantas Japoniae et Koreae XXVIII. Takenoshin NAKAI. [Bot. Mag., Tôkyô, **36** (1922), 117-123].

In this article the author has described the following new plants:—

1.	*Allium yesoense*	Yeso.
2.	*Polygonum neo-filiforme*	Hondo and Corea.
3.	*Machilus Thunbergii* var. *obovata*	Corea.
4.	*Astilbe glaberrima*	Isl. Yakushima.
5.	*Astilbe formosa*	Hondo.
6.	*Astilbe congesta*	Hondo and Yeso.
7.	*Boninia glabra* var. *crassifolia*	Bonin.
8.	*Meliosma hachijoensis*	Isl. Hachijyo.
9.	*Adenophora moiwana*	Yeso.
10.	*Carex tenuistachya*	Hondo.
11.	*Peperomia pacifica*	Sulphur Isl.

The following plants are to be added to the Korean Flora.

Nuphar pumilum, Pyrus Uematsuana, Daphne Genkwa, Wikstroemia trichotoma, Senecio pseudo-Arnica. Author.

74. Notulae ad Plantas Japoniae et Koreae XXIX. Takenoshin NAKAI. [Bot. Mag., Tôkyô, **37** (1923). 1-17.]

In this article the author has described the following new plants.

1.	*Thalictrum capillipes*	Hondo
2.	*Rubus pacificus*	Sulphur Isl.
3.	*Celastrus lancifolius*	Hondo
4.	*Vaccinium axillare* var. *platyanthum*	Hondo
5.	*Cynoglossum formosanum*	Formosa and Liukiu
6.	*Cynoglossum tosaense*	Shikoku
7.	*Cynoglossum villosulum*	Hondo et Shikoku
8.	*Cynoglossum asperrimum*	Korea, Quelpaert and Japan
9.	*Cynoglossum asperrimum* var. *yesoense*	Yeso
10.	*Goodyera yakushimensis*	Isl. Yakushima
11.	*Goodyera boninensis*	Bonin
12.	*Vicia pseudo-venosa*	Korea and Hondo
13.	*Vicia deflexa*	Hondo
14.	*Vicia senanensis*	Hondo
15.	*Vicia subcuspidata*	Korea
16.	*Vicia bifolia*	Hondo

He also distinguished a new section *Peramiopsis* of the genus *Goodyera* including *G. boninensis, G. yakushimensis* and *G. hachijoensis.* He has further given the keys to the all species of the group of *Vicia venosa* and all Japanese species of *Cynoglossum* and has described all of the varieties and forms of them. Author.

75. Notulae ad Plantas Japoniae et Koreae XXX. Takenoshin NAKAI [Bot. Mag., Tôkyô, **37** (1923), 69-82.]

This contains the following new species and varieties.

1.	*Asparagus verrucosus*	Corea
2.	*Chaenomeles eugenioides* var. *tortuosa*	Patria ignota
3.	*Lespedeza bicolor* var. *velutina*	Hondo
4.	,, *homoloba*	Japonia
5.	,, *intermedia*	Corea et Quelpaert
6.	,, ,, var. *alba*	Corea
7.	,, ,, var. *angustifolia*	Corea et Quelpaert
8.	,, *maritima*	Corea
9.	,, *melanantha*	Corea
10.	,, *patens*	Hondo
11.	*Euonymus alatus* var. *latifolia*	Corea
12.	*Eurya minima*	Patria ignota
13.	*Plectranthus lanceus*	Kiusiu

The change of scientific names is as follows.

Cydonia japonica var. *eburnea* to *Chaenomeles angustifolia* var. *eburnea*
Cydonia Manlei alba to *Chaenomeles angustifolia* var. *alba*
Pyrus japonica alba to *Chaenomeles eugenioides* var. *alba*
Cydonia Manlei var. *superba* to *Chaenomeles eugenioides* var. *superba*
Lespedeza Sieboldii to *Lespedeza pendutiflora*

Under *Chaenomeles angustifolia* the author has especially discussed the species of *Chaenomeles* and given the key for four known species of *Chaenomeles*. Besides, the following two species are added to the respective Flora.

Moricandia sonchifolia to Corea
Artemisia borealis var. *Wormskjoldii* to Hondo. Author.

76. Trees and Shrubs indigenous in Japan Proper. Vol. I. 511 pp. with 272 Text-figs. (Japanese). Takenoshin NAKAI. (1922), publ. by Seibidô Shoten, Tokyo.

This book is the first part of an illustrated ligneous Flora of Japan proper which contains all trees and shrubs of Gamopetalae beginning from Ericaceae and ending in Compositae. It contains 276 species and 113 varieties belonging to 20 families. The new sections and varieties which are contained in this book are as follows:—

Sections.

1.	*Tripetaleia*	sect.	*Eutripetaleia*
2.	,,	sect.	*Schizocalyx*
3.	*Menziesia*	sect.	*Heteromenziesia*
4.	,,	sect.	*Semimenziesia*
5.	*Rhododendron*	sect.	*Sinenses*
6.	,,	sect.	*Verticillatae*
7.	*Leucothoe*	sect.	*Paraleucothoe*
8.	,,	sect.	*Eubotryoides*
9.	*Meisteria*	sect.	*Eumeisteria*
10.	*Pterostyrax*	sect.	*Pentaptera*
11.	,,	sect.	*Decaveniae*
12.	*Styrax*	sect.	*Japonostyrax*
13.	,,	sect.	*Vaginostyrax*

Species.

1. *Phyllodoce tsugaefolia*
2. *Menziesia lasiophylla*
3. *Rhododendron glabrius*
4. ,, *nikoense*
5. ,, *eriocarpum*
6. ,, *lusiduscul um*
7. ,, *transiens*
8. ,, *hortense*
9. *Meisteria shikokiana*
10. *Arctous ruber*
11. *Vaccinium versicolor*
12. ,, *lasiocarpum*
13. ,, *nikkoense*
14. ,, *koreanum*
15. *Diapensia obovata*
16. *Osmanthus asiaticus*
17. ,, *aurantiacus*
18. ,, *ilicifolius*
19. *Ligustrum yesoense*
20. *Fraxinus intermedia*
21. ,, *yamatense*
22. *Trachelospermum majus*
23. *Callicarpa cinnamomea*
24. *Siphonanthus yakusimensis*
25. *Serissa crassiramea*
26. *Damnacanthus giganteus*

Varieties.

1. *Ledum palustre* v. *nipponicum*
   ,, ,, v. *yesoense*
3. *Menziesia ciliicalyx* v. *tubiflora*
4. *Rhododendron obtusum* v. *latifolium*
5. ,, ,, v. *majus*
6. ,, *Kaempferi* v. *macrogemmum*
7. *Cassiope lycopodioides* v. *laxa*
8. *Leucothoe Grayana* v. *venosa*
9. ,, ,, v. *hypoleuca*
10. *Pieris japonica* v. *monostachya*
11. *Oxycoccoides japonicus* v. *sinicus*
12. *Bladhia villosa* v. *liukiuensis*
13. *Ligustrum Tschonoskii* v. *leiocalyx*
14. *Ehretia thysiflora v. latifolia*
15. *Thymus Przewalskii* v. *laxa*
16. *Adina globiflora* v. *macrophylla*
17. *Gardenia floride* v. *boninensis*
18. *Damnacanthus indicus* v. *formosanus.* Author.

77. Abstract from T. NAKAI: "Trees and Shrubs Indigenous in Japan Proper Vol. I (1922)", with Additional Remarks on Some Species. Takenoshin NAKAI. [Bot. Mag. Tôkyô **38** (1924), 23-35, 37-48.] See the preceding entry.

78. Flora Sylvatica Koreana. XIII et XIV. Takenoshin NAKAI. (Mar. 1923). publ. by the Government of Chosen, 1-46, 13 pls. and 1-133, 29 pls.

It contains references, history of investigation, economic uses, distribution, classification of genera, species and varieties, synonymy, name-table and illustrations of species and varieties.

PARS XIII. Contains Diapensiaceae, Ardisiaceae, Ebenaceae, Symplocaceae and Styracaceae, including the following :—

Diapensia obovata
Bladhia japonica
Bladhia villosa
Bladhia villosa var. *Taquetii*
Diospyros Lotus
Diospyros Kaki
Palura paniculata
Palura paniculata var. *leucocarpa*
Palura Tanakana
Palura argutidens
Bobua prunifolia
Styrax japonica
Styrax Obassia

PARS XIV Contains Loganiaceae, Apocynaceae, Cordiaceae, Pyrenaceae, Labiatae, Solanaceae, Rhinanthaceae, Bignoniaceae, Rubiaceae and Compositae, including the following :—

Gardneria insularis
Trachelospermum a. pubescens
Trachelospermum asiaticum β. glabrum
Ehretia thyrsiflora
Callicarpa dichotoma
Callicarpa japonica
Callicarpa japonica var. *Taquetii*
Callicarpa japonica var. *luxurians*
Callicarpa mollis
Callicarpa mollis var. *microphylla*
Siphonanthus trichotomus
Siphonanthus trichotomus var. *ferrugineus*
Vitex rotundifolia
Vitex chinensis
Thymus Przewalskii
Thymus Przewalskii var. *magnus*
Lycium chinense
Paulownia tomentosa
Catalpa ovata
Campsis chinensis
Adina rubella f. *rubescens*
Adina rubella f. *viridis*
Paederia chinensis
Paederia chinensis var. *velutina*
Paederia chinensis var. *angustifolia*
Damnacanthus indicus a. genuinus
Damnacanthus indicus var. *latifolius*
Artemisia Besseriana a. triloba.

Artemisia Gmelini var. *Gebleriana*
Artemisia Gmelini var. *vestita*
Artemisia Messerschmidtiana a. viridis f. *typica*
„ „ „ f. *laxiflora*
„ „ var. *discolor*.
Aster Oharai

The enumerations of all Korean species belonging to Cordiaceæ, Pyrenaceæ, Labiatæ, Solanaceæ, Rhinanthaceæ, Rubiaceæ and Compositæ are added. Author.

79. Genera nova Rhamnacearum et Leguminosarum ex Asia orientali. Takenoshin NAKAI [Bot. Mag., Tôkyo, **37** (1923) 29-34).

This paper is the critics and descriptions regarding the new genus *Berchemiella* of Rhamnaceæ which includes *Chaydaia Wilsonii* and *Rhamnella berchemiaefolia*, and the new genus *Echinosophora* of Leguminosæ from Korea. Author.

80. Bacterial Disease of Hibiscus. (Japanese.) Kakugorô NAKATA and Seitô TAKIMOTO. [Ann. Phytopathol. Soc. Japan. I.5 (1923), 13-19.]

Since 1913, an undescribed bacterial leaf spots of *Hibiscus* has been under observation in Korea. The most noticeable lesions in leaves are found as irregular black spots which cause the distortion of the leaves. The causal bacteria have been isolated repeatedly and its pathogenicity proved by inoculation with pure culture. The disease is briefly described as follows:

Symptoms:—The disease affects the cotyledons, especially young leaves when 2-3 leaves are expanded, but reduced when the plants matured. The first signs of the disease are minute circular black spots which enlarge gradually and take circular or irregular outlines, and finally their margins become angular, being limited by the veins. The outer parts of the spots take an obscure whitish yellow colour or water soaked appearance, and when the leaves are severely attacked the whole plants become blackened and dry out.

Description of causal organism:—*Bacterium Hibisci*, n. sp. A cylindrical rod with rounded ends, single or in pairs usually, and in chains frequently, 1.2-2.0×0.6-0.7 μ in size, motile by means of 1-2 polar flagella, no spore or capsule formed. Grams negative, stains well in carbol fuchsin, anilin water gentian violet, and aqueous methylenblue; in agar plate, the surface colonies are smooth and circular with entire margin, slightly elevated in center, wet shiny and cement-like coloured by reflected light, fine granular in center under magnification; bouillon culture clouded after 20 hours at 25-27°C, and rim produced with heavy precipitate; gelatin slightly lignified, milk slowly peptonized, no gas produced, nitrate slightly reduced, no reaction of indol, thermal death point at 49°C, aerobic.

Infection experiments:—Inoculation by needle puncture with water suspension of 24 hours agar culture resulted in characteristic leaf spots but inoculation by spraying failed to give infections. When the seeds soaked with water suspension of agar pure culture are sowed, the germinated young plants showed lesions of bacterial blight on the cotyledons.

Our experiment shows that this organism overwinters on seed. In April 1921, the seeds were disinfected for 10 minutes with mercuric chloride (1 to 1000 parts of water) or hot water (55°C) and then sowed in large tube with sterilized sand. The plants germinated grew soundly and no disease was observed, but the plants from untreated seeds showed 50 per cent diseased leaves.

Control:—Our experiments for control during the season of 1919 and 1920 show that the seed disinfection is very effective, application of 5-5-50 Bordeaux mixture spray greatly reducing the disease.

81. On the Differences of Chromosomes in Various Races and Mutants of Rice-plant. (Japanese.) Sadao NAKATOMI. [Idengaku Zassi (Japan. Jour. Genetics) **2** (1923), 107-115, 2 figs.]

The author has studied the nuclear division of the pollen mother-cells in various races of rice-plant, including foreign, Japanese as well as anomalous (produced by mutation), altogether 21 in number. The general conclusions arrived at are firstly, that the haploid number of chromosomes is 12 and secondly, that the size of chromosomes is more or less different in different races. Author.

82. Comparative Morphology and Development of Poa pratensis, Phleum pratense and Setaria italica. Makoto NISHIMURA. [Japan Jour. Bot. **1** (1922), 55-85, 4 pls. and 2 figs.]

83. Studies in Plasmopara Halstedii. Makoto NISHIMURA. [Jour. Coll. Agr., Hokkaido Imp. Univ., **11** (1922), 185-210, 6 pls. and 7 figs.]

The author writes on *Plasmopara Halstedii*, paying special attention to the following :— (a) Infection of *Helianthus annuus* L. by the zoospores of this species ; (b) the mode of fertilization in this fungus. About (a) he mentions a new type of root infection for the Peronosporaceæ which is found in the *P. Halstedii*. Under (b) he deals with its fertilization in detail, pointing out especially that a monocyst (receptive papilla) is formed during the nuclear division of the oosphere, and that this monocyst protrudes into the antheridial cell ; this afterwards retracts and conducts a fertilizing tube from the antheridium into the center of the oosphere, etc. Author.

84. The Theory of the Formation of the Spherical Thallus in Aegagropila Sauteri (Nees.) Kutz. (Japanese). Makoto NISHIMURA. [Bot. Mag. Tokyo **37** (1923), (105)-(117), 1 fig., 2 graphs, 1 pl.]

Author's studies indicate that the small spherical thallus formation of *Aegagropila Sauteri* (Nees) Kutz. is an example of the adaptation phenomenon in floating life.

The important facts concerning the spherical thallus formation of the plant may be pointed out as follows :—

1. The thallus gradually revolves by means of the changing of the center of gravity and the center of buoyancy in the course of its normal development. Consequently the new surface of the thallus is placed in the best conditions for development.

2. The preceding phenomenon, the revolution is aided by the characteristic migration of the plant even in calm water.

3. In the beginning the single thread of the thallus does not revolve easily, but when it becomes a small sphere it revolves usually by wave-motion, because then both the center of buoyancy and the center of gravity come to one point in the center of the thallus.

4. The rhizoids of this plant act as connecting organs for the thallus.

5. The continual pressure of water acting equally on the whole surface of the thallus causes it to become more and more compact.

In short, the spherical thallus of *A. Sauteri* is formed by the synthetic action of the preceeding factors. This theory applies to *A. Sauteri* because it has elastic cell walls. If its cell walls were soft it would never become a spherical thallus. Author.

85. Studies on the Helminthosporiose of the Rice-plant. Yosikazu NISIKADO and Chûichi MIYAKE. [Ber. Ôhara Inst. f. landw. Forsch. **2** (1922), 133-195, 7 pls.]

The helminthosporiose of rice-plant, a serious disease caused by *Helminthosporium Oryzae* Breda de Haan, and very common in Japan, is characterized by the production of small "Sesamum"-like brown discolored spots on leaves ; it attacks besides the latter seedlings, culms,

necks, heads, etc. The authors have isolated various strains and made their pure cultures in various nutrient media, such as rice-, beef-, potato-, cherry leaves-, onion soy-agar, etc. and their variation in such media was studied. The conidiophores are erect hyphae which arise in tufts of two to five or more and are septate. They were studied biometrically: their length varies in different media and is 43 μ to 533.2 μ, width 5,1 μ to 12,75 μ, the number of septa varies from 2-22. Conidia single at the tips of the conidiophores, 2-13-septate; they were studied biometrically: the measurement of 600 conidia has given for length M=73,951±0,566 μ, st. dev.=20,553±0,04 μ, for width M=17,213±0.046 μ, st dev.=1,681±0,033 μ, for number of septa M=6,647±0,086, st. dev. 3,138±0,037. Inoculation experiments on a number of Gramineae were performed with success in many cases. The germ-tube is enveloped by a thick gelatinous sheath, as easily recognizable by staining it with gentian violet; this sheath serves to let the germ-tube adhere firmly to the host tissue. Appressoria are also found. The germ-tubes penetrate the host tissue partly through open stomata, partly through epidermal cells, the latter act being effected by mucilaginous sheath and appressoria.

Optimum temperature for the conidial germination lies between 25°-30°, minimum 2° and maximum 41°; optimum for mycelial growth lies between 27° and 30°. Minimum for conidial formation 5°-6°, maximum 36°-38°. The death point in the case of ten minutes' exposure is 50°-51° for conidia, and 48°-50° for mycelia.

The susceptibility of conidia to various chemical substances was tested: they are very susceptible to $CuSO_4$, $HgCl_2$, $AgNO_3$, calcium hypochloride, formalin, etc.

It may be added that the fungus may live for pretty long time: it was found that in culture it has retained its vitality as long as 943 days. Authors.

86. Ueber die durch Physalospora und Coniothyrium verursachten Krankheiten derWeintraube in Japan. Yosikazu NISIKADO. [Ber. Ohara Inst. landw. Forsch. 2 (1923), 273-289.]

I. Die im Kaukasus vorherrschende, durch *Physalospora baccae* CAVARA verursachte Krankheit der Weintraube wurde seit 1913 auch in Japan beobachtet. Das erste Zeichen der Erkrankung ist dabei eigenartige dunkle Flecke an den grünen Stielen der beinahe reifen Beeren, welche schnell um die letzteren herumvergrössern; an jedem Flecke erscheinen zahlreiche schwarze Pusteln, worin bald die Pykniden eintreten. Die Beeren dann vertrocknen und schrumpfen. Die Pykniden- und Perithezienform sind ausführlich beschrieben. Die Kultur auf verschiedenen Nährböden wurde angestellt, von denen Beerendekoktagar und Kartoffelscheibe die beste Resultate gegeben haben. Auch wurde der Einfluss der H-ionenkonzentration auf die Entwicklung untersucht, wobei es sich ergab, dass der Pilz in Nährböden von pH=3,4-10 wachsen kann, und in denselben von pH=4,2-7,4 bestens gedeiht.

II. Die durch *Coniothyrium Diplodiella* (SPEG.) SACC. verursachte Krankheit der Weintraube wurde zuerst 1913 vom Verf. in Japan aufgefunden. Die braunen Flecke erscheinen an den Trauben- oder Beerenstielen, und dann werden die Beeren faulig und vertrocknen. Auf ihre Oberfläche erscheinen Pusteln, worin die Pykniden sich entwickeln. Der Pilzform wird ausführlich beschrieben. Die Kultur auf verschiedenen Nährböden (z. B. Beerendekoktagar) wurde gemacht mit vorzüglichen Resultaten. Die Impfversuche wurden auch angestellt und haben positive Erfolge gegeben. Autoref.

87. Effect of Temperature on the Growth of Helminthosporium Oryzae Br. D. Haan. (Japanese). Yosikazu NISIKADO. [Ann. Phytopathol. Soc. I.5 (1923), 20-30.]

(1) The present paper deals with the thermal effect on the germination of the conidia, the growth of the mycelium and the formation of the conidia of *Helminthosporium Oryzae*, and also the thermal death point.

(2) The optimum temperature for the germination of the conidia lies between 25° and 30°C., at which temperature the greatest germination percentage (70 per cent or more) of conidia is secured.

(3) The minimum temperature for conidia germination is 2°C. The germ tubes produced at this temperature are spherical or elliptical and swell up pronouncedly; they are never linear, as those of normal shape.

(4) The maximum temperature for conidia germination is 41°C, at which the germ tubes are also spherical or elliptical, but smaller than those formed at 2°C.

(5) The best growth of the mycelium was secured at a temperature between 27° and 30°C.

(6) The maximum temperature for the formation of the conidia is between 35° and 38°C, and the minimum temperature 5°C.

(7) Conidia formed at the optimum temperature, are obclavate and curve to one side; those formed at 5°C are cylindrical and straight and have a smaller number of the septa; and those at 30°C are shorter and wider than those formed at 20°C.

(8) Conidia formed at lower temperature are dark in color, and become lighter with the rise of temperature.

(9) The thermal death point (under 10 minutes exposures) for the conidia is 50-51°C; and for the germinated conidia on hyphæ 48-50°C. Author.

88. Genetic Studies on Spinacia. (Japanese). Sigeroku NOHARA. [Idengaku Zassi (Japan. Jour. Genetics) **2** (1923), 45-54]. S. the next entry.

89. Genetic Studies on Spinacia. Sigeroku NOHARA. [Japan. Jour. Bot. **1** (1923), 111-120].

90. Experimental Studies on Pollen of Some Salix. Sigeroku NOHARA. [Japan. Jour. Bot. **2** (1924), 1-33,2 plates and 8 figures.]

91. On the Longevity of Seeds of Nelumbo nucifera. (Japanese). Ichiro OIGA. [Bot. Mag. Tôkyô **27** (1923) 87-95, 7 figs.]

Seeds of *Nelumbo nucifera* were found in some place of South Manchuria, buried in peat layer, where, according to the author's opinion, they must have remained at least 120 years, or probably 200 or even 400. Their water-content was found to be in testa 11.93%, in the endosperm 11.43%, and in the embryo 9.33%. The seeds were found to germinate after a few days, when their one or both ends were filed. S. Ikeno.

92. Icones of Japanese Algae. Kintarô OKAMURA. **4**, No. 10 and **5**, No. 1 (1923), Tôkyô, each No. with 5 plates, 185-205 and 1-19.

4, No. 10 contains *Odonthalia ochotensis* (Rupr.) J. Ag., *Symphyocladia pennata* sp. nov., *Trichogloea lubrica* (Harv.) J. Ag., *Plocamium costatum* (J. Ag.) H. et H., *Dasyphila plumarioides* Yendo, *Gelidium crinale* (Turn.) Lam. f. *latifolium* n. f., *Homoeostrichus Sinclairii* (H. et H.) J. Ag., *Desmarestia aculeata* (L.) Lam., *Canderpa Freycinetii* C. Ag. var. *pectinata* Web. v. Bos., C. *cupressoides* C. Ag. var. *typica* Web. v. Bos., var. *lycopodioides* f. *elegans*, *Derbesia Lamourouxii* (J. Ag.) Solier.

5, No. 1 contains *Coccophora Langsdorfii* (Turn.) Grev., *Sargassum Horneri* (Turn.) C. Ag., S. *Thunbergii* nov. comb. (*Cystophyllum Thunbergii* J. Ag. combined with *Cystophyllum Swartzii* J. Ag.), S. *nigrifolium* Yendo and S. *duplicatum* J. Ag. Author.

93. Untersuchungen über die Wirkung der Gase, welche im Reisfelde bei der Zersetzung von Gerste (Astragalus sinicus) entstehen, auf das Wachstum der Reispflanzen. Isenosuke ONODERA. (Ber. Ôhara Inst. landw. Forsch. **2** (1923), 361-381, 9 Tafeln und 1 Textabbild.]

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94. Wie kann man die schädigende Wirkung der bei der Zersetzung von Genge (Astragalus sinicus) entstehenden Gase auf das Wachstum der Reispflanze verhindern? Isenosuke ONODERA. [Ber. Ôhara Inst. landw. Forsch. **2** (1923) 383–396, 1 Textabbild.]

95. Beschreibung von zwei neuen Hefearten, nebst Bemerkungen über die Sporenbildung bei Torulaspora Delbrücki, Lindner. Kendo SAITO. [Bot. Mag. Tôkyô, **37** (1923), 63–66].

Der Verfasser beschreibt zwei neue Hefearten.

I. *Zygosaccharomyces mongolicus* n. sp.

Sprosszellen kugelig bis oval, hyalin, 5–6.5 μ lang, 4–5 μ breit. Abnorme Zellformen häufig. Riesenkolonien radial gestreift. Parthenoasken reich. Askosporen kugelig und glattwandig. Grenztemperaturen für die Sprossung 30–32°C und 6–8°C. Grenztemperaturen für die Ausbildung der Kopulationsfortsätze 25–30°C und 10–14°C. Vergärt Dextrose, Laevulose, Mannose und Galaktose. Hautinseln gebildet. Assimiliert als Kohlenstoffquelle Dextrose, Laevulose, Galaktose, Glyzerin und Mannit, und als Stickstoffquelle Ammoniumsulfat, Asparagin, Alanin, Leucin, Harnstoff. Isoliert aus Sauermilch die von Mongolen in einem Getränke (Naisu-chiu) verarbeitet wird.

II. *Torulaspora fermentati* n. sp.

Sprosszellen klein, kugelig, 4–6.5 μ im Durchmesser. Oeltröpfchen in alten Zellen. Riesenkolonien gleichmässig geformt. Askosporen kugelig und glattwandig. Grenztemperaturen für die Sprossung 38–39°C und 6–8°C. Grenztemperaturen für die Askusbildung 30–10°C. Vergärt Dextrose, Laevulose, Maltose, Saccharose, Raffinose leicht, aber Trehalose nur schwach. Keine Hautbildung. Assimiliert als Kohlenstoffquelle Dextrose, Saccharose, Maltose, Glyzerin, Mannit und Dextrin, als Stickstoffquelle Ammoniumsulfat, Asparagin, Alanin, Pepton, Tyrosin und Harnstoff. Isoliert aus der Maische des mandschurischen Sorghumbranntweins.

Nach dem Versuche vom Verfasser bildet *Torulaspora Delbrücki* leicht Sporen, wenn die Gipsblockkulturen in einem Gemisch von 18 ccm. 0.5–1%iger Mannit- oder Glyzerinlösung mit 2 ccm. 5%iger Dikaliumphosphatlösung eingetaucht sind. Askosporen kugelig und glattwandig. Grenztemperaturen für die Askusbildung 30–34° und 8–14°C. Autoreferat.

96. On the Genetics of Setaria italica. (Japanese). Syûiti SAITO. [Idengaku Zassi (Japan. Jour. Genetics) **2** (1923), 67–70, 1 pl.]—I. What are called "stiff hairs" in *Setaria italica* are the bristles which are found near the lowar ends of each grain, and which are developed from the upper extremities of spikelet stalk. Their number for each grain varies from 2–9. They are either long or short. Long×short gives long, and in F_2 the segregation follows the monofactorial type.

II. In general the branches of the panicle are very short, and not conspicuous, so that the whole panicle resembles in some respects the tail of some animals. In one race each panicle is provided with a number of long conspicuous branches. The hybrids between these two types possess the panicle of the latter. In F_2 we see besides both parent types various intermediate ones, whose exact classification is somewhat difficult, but if we classify the whole into ordinary type and that with more or less conspicuous branches, we observe the 9 : 7 segregation, i.e. we have here to deal with a dihybrid segregation. It is clear that various intermediate types of panicle are chiefly due to various combinations of two factors.

III. The grain colour is various, i.e. orange, yellow, red, black, etc. The hybrid red× orange gives orange. In F_2 we have orange : red : yellow = 12 : 3 : 1, though orange and yellow are often scarcely distinguishable. The author's conclusion is as follows: **A** = red, **a** = yellow, **B** = orange, **b** = yellow, and **A** is epistatic to **B**. Author.

97. Über die Selbstvergiftung der Spirogyren im destillierten Wasser. Tetsu SAKAMURA. [Bot. Mag. Tôkyô, **36** (1922), 133-153.]

Die stärkereichen Spirogyren („gesättigte Pflanzen") gehen im Kupfer freiem destillierten Wasser schon im Verlauf einer Nacht zugrunde, während diejenigen die an Stärke arm sind, („Hunger pflanzen"), in solchem destillierten Wasser immer normal weiterleben. Die gesättigten Pflanzen scheiden als Stoffwechselprodukte saure Substanz, wahrscheinlich Kohlensäure aus, die besonders im Dunkeln im Medium sich anhäuft. Da die Pufferwirkung dem destillierten Wasser fehlt, genügen die saure Substanzen schon in kleiner Menge, die echte Acidität im destillierten Wasser derart zu erhöhen, dass die Spirogyren geschädigt werden. Die starke Hypotonie übt dabei keine besondere schädliche osmotische Wirkung aus. Die Schädigung der stärkereichen Spirogyren ist also Selbstvergiftung. Die giftige Grenzkonzentration der Wasserstoffionen beträgt ungefähr pH=5.

Die schädliche Erhöhung der Acidität im destillierten Wasser kann vermieden werden, wenn man die Pflanzen die ganze Nacht hindurch beleuchtet, wodurch eine fortwährende CO_2-Assimilation ermöglicht wird. Da dem Ca-Carbonat mancherlei Vermögen, eine Puffer-, eine Neutralisations- und eine antagonistische Wirkung gegen die Wasserstoffionen zukommt, so dient das als das beste Schutzmittel gegen diese Selbstvergiftung der Spirogyren.

In der Zusammenfassung ist es auch angezeigt, bei gewissen physiologischen Untersuchungen möglichst zu vermeiden, stärkereiche Spirogyren als Versuchsmaterialien zu brauchen.

Autoref.

98. Über die Selbstvergiftung der Spirogyren im destillierten Wasser. (Japanisch.) Tetsu SAKAMURA. [Bot. Mag. Tôkyô **36** (1922), (151)-(197). S. Nr. 97].

99. Über die Bildung der Anthranilsäure aus l-Tryptophan durch Subtilisbakterien. Takaoki SASAKI. [Jour. Biochem. Tôkyô **2** (1923), 251-254.]

100. Studies on the Forest Zones of Mt. Morrison Range (Formosa). Syun'iti SASAKI. [Report of Dept. of Forestry, the Research Institute of the Government of Formosa **1** (1922), 1-108 with 8 pls., 1 map and 2 tables].

Mt. Morrison in Formosa (Japanese name "Niitakayama") is the highest mountain in whole Japan and reaches an elevation of the 4166 metres level. It is situated in Middle Formosa, just in the Tropic of Cancer, so that at its foot we see the *tropical forest zone*. In this zone *Areca Catechu, Mangifera indica, Euphoria longana* and *Bambusa stenostachya* are in cultivation and flourish very well, while *Bombax malabricum* is in naturalised condition. *Acacia Farnesiana, Breynia officinalis, Macaranga Tanarius, Kleinhovia Hospita, Alpinia nutans, Pandanus tectorius* are growing wild. In the virgin forests occurring there we meet with *Cordia Myxa, Machilus Kusanoi, Macaranga Tanarius, Laportea pterostigma, Morus acidosa, Ficus leucantatoma, F. nervosa, F. Harlandi, Tetrapanax papyrifera, Sapindus Mukurosi, Liquidambar formosana, Bischoffia javanica, Didymosperma Engleri, Dendrocalamus latiflorus, Alsophila latebrosa.* Soil surface is densely clad with plants, such as *Alocasia macrorhiza, Musa formosana, Strobilanthes flaccidifolius, S. formosana. Epipremum mirabile, Milletia reticulata, Bauhinia Championi, Mucuna ferruginea*, etc. are some instances of lianes found in such forests. The tropical forest zone attains the height of the 753 metres level.

Higher than the latter elevation till almost 2430 metres extends the *warm forest zone*, of which the lower half is what the author calls the *"tropico-warm"* zone (extending till 1670 metres), because plants of tropical as well as of warm forest zone properly so-called are found there growing together. The *tropico-warm forest zone* which abounds in moisture as much as the tropical forest zone itself is characterised by the occurrence of evergreen angiospermous trees, bamboos, *Calamus* and tree-ferns. Some instances of plants there found may be cited:

Cyathea spinulosa, Alsophila latebrosa, Musa formosana, Phoebe formosa, Helicia formosana, Cinnamomum Camphora, Alniphyllum Fortunei, Styrax suberifolium, Liquidambar formosana, Alnus formosana, Machilus Kusanoi, Heptapleurum octophyllum, Lagerstroemia subcostata, Castanopsis taiwaniana, Illicium arborescens, Echinocarpus dasycarpus, etc. etc.

The flora of *warm forest zone* (upper half of tropicowarm zone) is characterised by evergreen trees, belonging chiefly to *Quercus* and other Cupuliferae, for instance, *Q. Kawakamii, Q. stenophylla, Q. serrata, Castanopsis Kawakamii, C. Kusanoi, C. taiwaniana, Lithocarpus castanopsifolia, Pasaniopsis Junghuhnii. Quercus serrata* forms pure forests extending through several kilometres. Epiphytes are abundant, such as *Asplenium Nidus, Polypodium cornans, Vittaria, Dendrobium*, etc.

The *temperate forest zone* which reaches the height of more than 3030 metres, is divided into two parts. In the lower half (till 2400 metres), where frost and snow fall in winter we see a much larger number of deciduous trees than in the warm forest zone. The Conifers form here dense forests. *Chamaecyparis, Pinus, Acer, Alnus, Arundinaria, Heptapleurum, Pasaniopsis, Villebrunea, Polygonum, Rosa, Plagiogyria, Pteris, Gleichenia, Lycopodium* are some instances of plants growing there. The pure forest of *Chamaecyparis formosensis* begins to appear at an elevation of almost 2100 metres, and that of *C. obtusa* at that of 2400 metres.

The upper half of temperate forest zone is characterised by the occurrence of *Tsuga chinensis* which forms pure forests of colossal dimension. We have besides pure forests of *Pinus taiwanensis, P. Armandi, Taiwania cryptomerioides, Picea morrisonicola*. The Rubi and Lauraceae of alpine character, *Arundinaria, Berberis, Mahonia, Polygonum, Pinus, Pourthiaea, Osmanthus, Juniperus formosana, J. squamata, Abies Kawakamii, Quercus stenophyllodes, Q. arisanensis, Q. spinosa* var. *Miyabei* are also found.

In the *cold forest zone* which occupies the region higher than 3030 metres we see the luxuriant growth of shrubs of low stature which densely cover the soil surface, belonging to the genera *Juniperus, Rhododendron, Berberis*. Even at the very summit of the Mountain such plants, as *Juniperus squamata, Rhododendron pseudochrysanthum, Abies Kawakamii, Berberis morrisonicola, Salix* sp. are growing, though rather meager.

The flora of Mt. Morrison Range comprises besides a large number of endemic species plants of Himalayan region, India, Ceylon, Cochinchina, Malayan Peninsula and Archipelago, China, Manchuria, Corea, Japan proper, Hokkaidô, Sachalien, Kurile and Bonin Islands. The number of endemic species is as follows: tropical forest zone 76 species (=31% of total in this region), warm forest zone 126 (=46%), temperate forest zone, lower half 109 (=68%), the same, upper half 49 (=73%), cold forest zone 20 (=74%), so that among 477 species in all 235 (=33%) are endemic.

At the end of the paper a list of all plants known from Mt. Morrison Range is given, together with their distribution in other parts of the world. Author.

101. Plant Zones in Mt. Morrison and Oecological Observations on its Plants. (Japanese.) Syun'iti SASAKI. [Report of Nat. Hist. Soc. Formosa **13** (1923), 121-174.]

102. Materials for the Mycological Study in Formosa. No. 24. (Japanese). Kanyoshi SAWADA. [Trans. Nat. Hist. Soc. Formosa **62** (1922), 77-84.]

1. **Albugo Ipomaeae-aquaticae** nov. sp. On *Ipomaea aquatica*.

2. **Pseudoplasmopara,** gen. nov. Mycelium running through the intercellular spaces of host and provided with ovate haustoria; conidiophores protruding through stomata, several times di- or trichotomously branching; branching right-angled or nearly so; terminal branchlets truncate and tufted, each with a conidium at its apex; conidia ovate and producing the germ-tube; no oospores yet seen. Conidiophores and conidia entirely similar to those of *Plasmopara*

but distinguished by the production of germ-tubes instead of swarmspores in germination. **Pseudoplasmopara Justiciae** sp. nov. on *Justicia procumbens*.

3. **Protomyces Lactucae** sp. nov. On *Lactuca* sp.

4. **Kordyana Commelinae** sp. nov. On *Commelina nudiflora*. Author.

103. Untersuchungen über das Baicalin, eine neue Flavon-Glucuronsäure-Verbindung aus den Wurzeln von Scutellaria baicalensis. Keita SHIBATA, Shojiro IWATA und Makoto NAKAMURA. [Acta Phytochim. **1** (1923), 105-130, 1 Tafel.]

104. Über die Absorptionsspektren der Pflanzenfarbstoffe der Flavonreihe. I. Yuji SHIBATA und Kensho KIMOTSUKI. [Acta Phytochim. **1** (1923), 91-104, 2 Tafeln.]

105. Über eine Botrytiskrankheit der Erdnuss (Arachis hypogaea L.). Naozi SUEMATU. [Japan. Jour. Bot. **2** (1924), 35-38, 2 Tafeln.]

106. Some Examples of the Production of anomalous Races in Rice-plant. (Japanese). Sigeo SUGIMOTO. [Idengaku Zassi **2** (1923), 71-75].—I. In general the dwarf race of rice-plant is genetically recessive to the typical one. Certain offspring derived from the races Sekitori × Aikoku made in 1901 were cultivated for some years, and have bred true. In 1910 one dwarf plant has appeared among them (in average original type 1,1 metre high, dwarf one 0,7 metre high). In 1921 it has given dwarf: ordinary in 3 : 1 ratio, so that it may be considered that the original dwarf plant has appeared as a monofactorial heterozygote, owing to the mutation of one of the two recessive genes of an allelomorphic pair to the dominant one.

II. In 1919 the author has got among almost 30,000 individuals of a pure line of the race known by the Japanese name Wasesinriki No. 1 one dwarf plant. In 1920 the latter has given rise to ordinary and dwarf offspring in 3 : 1 ratio, which was confirmed by F_3 culture. It may be seen from such results that the appearance of this dwarf plant is due to the mutation of one of the two dominant genes of an allelomorphic pair to the recessive and that it has appeared first as the monofactorial heterozygote. This case is just the reverse of what was described under I.

III. In one anomalous race got by the author, flowers are produced only at the apex of side-branches and are longer than usual ; anthers are flat and contain no pollen, pistils have no stigmas, and consequently the race is quite sterile. It has first appeared in 1919 as the offspring of an ordinary fertile plant; they were composed of 21 ordinary and 8 anomalous types, i.e. in almost 3 : 1 ratio. The further cultivation of some offspring of the ordinary type in 1920 has given rise again to ordinary : anomalous in 3 : 1 ratio. The author thinks that this anomalous plant has arisen as the heterozygote in 1918, but owing to the dominancy of the ordinary type it became visible first in 1919.

IV. In 1919, among nearly 30,000 offspring in a pure line of the race Wasesinriki No. 1 two anomalous races were discovered. One of them is characterised by the fact that the grains are longer and more loosely arranged on the axis than usual, while in another they are shorter and more densely arranged than usual. Both races have bred true immediately to their respective types. Author.

107. On Some Derivatives of the Fucose. Tetsutaro TADOKORO and Yukihiko NAKAMURA. [Jour. Biochem. Tôkyô **2** (1923), 461-471.]

108. Keimentwicklung von Sargassum. (Japanisch). Masato TAHARA. [Bot. Mag. Tôkyô **37** (1923), (159)-(161).]

Das Oogonium von *Sargassum* hat zuerst acht Kerne. Dann degenerieren sechs von ihnen und die zwei noch intakten Kerne weichen auseinander nach den entgegengesetzten Polen. Die

erste Scheidewand bildet sich dann etwa in der Aequatorialebene und hierauf gehen in den zwei neugebildeten Zellen die ersten Kernteilungen simultan vor sich. Es gibt kein einkerniges Stadium einer Oospore. Verfasser.

109. Studies on the Varieties of Sake Yeast, Saccharomyces Saké (Kozai), Yabe. Teizo TAKAHASHI, Matao YUKAWA, Junshiro OKUMURA, Kamajiro EDA and Takeharu YAMAMOTO. [Jour. Agric. Coll., Imp. Univ., Tokyo **7** (1922), 81-118, 6 pls.]—Yeasts obtained from various factories in Japan were isolated and purified. Their slant culture in koji-extract agar were examined after 15 months and their characteristics were studied: scarcely any difference may be found between the form of the varieties of saké yeast in common culture with rare exceptions, but in old culture we may recognize the change of shape, club-shape, citron- or pear-shape, or irregular form. Spore-formation takes place in all varieties examined except two; optimum temperature 30°, and 16-20 or 40 hours are required for sporulation. Spores round or elliptic, 2,5μ-4μ in diameter, 1-4 in each ascus. No. film formation was observed at 40°; but it takes place at lower temperature, varying from 15°-35° according to different varieties.

Gigantic colonies are formed and according to their form saké yeast may be classified into nine types.

The general results concerning their behavior towards sugar are in accordance with those of other authors, but there are some specialities. Some variety ferments mannose very feebly, some are not able to ferment galactose, while others ferment it very energitically. Almost half the number of the varieties are unable to ferment α-methyl-glucoside and two varieties were found to be unable to ferment raffinose. The authors have observed the fact thet some varieties which ferment saccharose owing to their invertin are able to ferment raffinose very feebly, which proves that raffinase is a special enzyme. A kind of *Torula* was observed that ferments raffinose and galactose but not saccharose, melibiose and fructose, perhaps owing to the presence of emulsin which gives rise to galactose from raffinose.

The fermenting energy studied after the method of Meissl was found to vary from 50-70, and very rarely to be under 50.

The real coefficient of fermentation lies generally between 50-60, rarely 70 or below 50. The quantity of acids formed is 0,06-0,09% in general, but rarely 0,13% or below 0,04%. The quantity of alcohol formed under the same condition was 2-4 vol. %, the highest coefficient of assimiltion of amino-acids is 83. Authors.

110. On the Budding Fungi of "Shôyu-moromi." Teizo TAKAHASHI and Yonesaburo SANO. [Jour. Agric. Coll., Imp. Univ. Tokyo 7 (1922), 119-155, 1 pl.]—The authors have studied seventy samples of Shôyu-moromi derived from various factories in three ripening stages (young, medium, old) and found the following new budding fungi:

I. Film-forming *Zygosaccharomyces*
   Z. salsus var. *saccharosum* I
   „ „ „ „ II
II. Non film-forming *Zygosaccharomyces*
   Z. Soja var. *saccharo-raffinosum*
III. Asporogenic *Zygosaccharomyces*
IV. *Torula*
   a. *Torula* No. 1
   b. non film-forming varieties
      Torula II-VIII;

V. Red yeast
No. 1–3
VI. *Willia*
2 varieties
VII. *Mycoderma*
VIII. *Saccharomyces*
IX. *Oidium* and *Sachsia.*

Of each fungus the size, form, spore-formation, products of fermentation, the behavior towards various chemical substances, etc. are given. Authors.

111. Ein Beispiel der Faktorenkoppelung bei Reispflanze. (Japanisch). Noboru TAKAHASI [Idengaku Zassi (Japan. Zeitsch. Vererbungslehre) **2**, 1923, 23–30].

Die in diesem Aufsatz beschriebenen Beobachtungen wurden an den zuerst durch die natürliche Kreuzung produzierten Pflanzen gemacht. Die hier in Rede stehenden Merkmale betreffen sich erstens den Character des Endosperms, ob es zum gewöhnlichen oder dem Klebreistyp gehört, und zweitens die Farbe der Granne oder Spelzenspitze, ob sie rot, erst schwach gelb und dann rot, oder weiss ist. Die Endospermmerkmale spalten sich wie gewöhnlich nach 3 : 1 Verhältnisse (d.h. gewöhnlich : Klebreis = 3 : 1). Die Farbenmerkmale der Granne oder Spelzenspitze spalten sich nach 9 : 3 : 4 (rot : gelb-rot : weiss). Nach der Verf.'s Ansicht rot = **CCRR**, weiss = **ccRR**, F_1 = **CcRr**, und gelb-rot = in F_2 entstandene **CCrr**, oder **Ccrr**.

Wenn man bei der F_2-Spaltung die obengenannten Endospermen- und Farbenmerkmale in Betracht zusammenzieht, so sieht man, dass das berechnete Spaltungsverhältnis bedeutend von dem gefundenen abweicht. Dies hat den Verf. zur Annahme der Verkoppelung zwischen den Faktoren **C** (für Farbe) und **U** (für gewöhnlichen Endospermtyp) geführt und wenn man dabei den Genenaustauschwert zu ungefähr 21% abschätzt, so hat man die gute Übereinstimmung mit der Theorie. Verf.

112. On the Effect of Ultraviolet Rays upon Nuclear Divisions of Plants. (Japanese.) Noboru TAKAMINE. [Bot. Mag. Tôkyô **37** (1923), (181)–(185), 1 pl.] S. the next entry.

113. On the Effect of Ultraviolet Rays upon Nuclear Divisions of Plants. Noboru TAKAMINE. [Bot. Mag. Tôkyô **37** (1923), 109–112.]

The young root-tips of *Vicia Faba* and *Allium Cepa*, as well as pollen mother-cells of *Capsella* and *Lactuca* were exposed to ultraviolet rays during 1/2–3 hrs. The following facts were observed:

1. The constrictions of each chromosome become more distinct than otherwise, and when the rays are very intense, they may be broken up at the constrictions.
2. Karyoplasmic masses are scattered irregularly.
3. Irregular distribution of chromosomes is observed, and sometimes tripolar divisions of somatic nuclei occur.
4. In the pollen formation some tetrad-cells do not develop into pollen grains, but degenerate.
5. Not only in the present experiments upon materials treated with ultraviolet rays, but also in the author's earlier experiments upon those not treated in this way, he has found that the number of karyoplasmic masses does not correspond to that of definite chromosomes, so that he cannot confirm the OVERTON'S view on the so-called prochromosomes. Author.

114. On the Change of Vegetation of the Tarumai Volcanic Range. (Japanese.) Makoto TAKENOUCHI. [Bot. Mag. Tôkyô **37** (1923), (161)–(181), 5 figs.]

This work is a contribution to the ecological study of the Tarumai Volcanic range, which is situated in South-western part of Hokkaido. This range contains two prominent peaks, Tarumai and Fuppushinupuri. The former is an active volcano, and the latter is an extinct one. The zonal distibution of plants and an upper bare region covering a large area, which are clearly seen on the Tarumai, form a striking contrast to rich forests of the Fuppushinupuri, where we see no zones except the poor shrubby region near its top. According to the author's study, the zonal distribution of plants on the Tarumai is due to the recent development of vegetation on a volcano of recent activity. And the vegetation is now unstable, and constantly changing. In the course of time, it seems to become fixed gradually from the lower and approaches to that of Mount Fuppushinupuri. He also points out that the slopes of Mount Tarumai being loosely made, are easily erosed by water, where a destruction of vegetation happens with a new succession of plants. Author.

115. Morphological Studies on the Leaf-blades of Sugar-canes. (Japanese). Yoshio TAKENOUCHI. [Report of Agric. Dept., the Research Institute of the Government of Formosa **1** (1922), 1-93, 8 pl.]—This paper contains the results of anatomical investigations on leaf-blades of various races of sugar-canes. The author has studied forms and size of leaf-blades, their anatomical structure, stomata, size of cells situated between stomata, vascular bundles, trichomes, etc. In the first chapter the general results of the researches are described and in the second the results of comparative studies on 15 different races are enumerated.

Author.

116. Über die Vererbung der Blattfarbe bei den purpurnen Reispflanzen II. (Japanisch.) Yosinori TAKEZAKI. [Idengaku Zassi (Zeitsch. Japan. f. Vererbungslehre) **2** (1923), 95-101.]

Früher [s. Japan. Jour. Bot. **1** (1922), (14), Nr. 34] hatte der Verf. die Mitteilung gemacht, dass bei den von ihm untersuchten purpurnen Reispflanzen die purpurne Farbe der Zusammenwirken von den drei Faktoren **A, B** und **C** zu verdanken ist und dass das Fehlen von nur einem derselben zur Produktion der grünen Pflanzen führen muss. Bei der Kreuzung **AABBCC** (purpurn) × **aabbcc** (grün) ist es mithin zu erwarten, dass in F_2 und allen folgenden Generationen der Verf. die grünen Pflanzen bekommen wird, von denen einer von den oben genannten drei Faktoren mangelt. Unter der Voraussetzung, dass die Kreuzung zwischen solchen grünen Individuen von verschiedener Zusammensetzung zur synthetischen Produktion von purpurnen Pflanzen führen muss, da **A, B** und **C** wieder in einer und derselben Zygote zur Vereinigung kommen, hat der Verf. eine Anzahl von solchen Kreuzungen ausgeführt und damit die Tatsachen bestätigt. Der vorliegende Aufsatz ist eine ausführliche Beschreibung seiner Experimente, wobei die darüber erhaltenen Zahlenangaben tabellarisch angegeben sind.

Autoref.

117. On the Vitality of Cercospora beticora, (Japanese.) Seitô TAKIMOTO. [Ann. Phytopathol. Soc. I. 5 (1923), 43-44.]

(1) The spores of *Cercospora beticora* kept in dry condition at the laboratory were active for 16 months.

(2) The spores infected in the seeds were able to germinate until the end of April (sowing season) of the next year.

(3) The spores of diseased leaves kept under caves were not able to germinate in the beginning of May, but sclerotial bodies or mycelia in tissue were alive through the winter.

(4) The spores of diseased leaves placed on the soil in the field of Suwon (Korea) lose thier vitality in the beginning of May but the sclerotial bodies or mycelia in tissue were very often able to germinate. The same result was obtained in Heijo, (Korea) but a few spores on the

under parts of the pile were able to germinate in the case where beet roots were covered with thin layer of soil.

(5) The spores of diseased leaves mixed with the wet soil died after 3 to 4 weeks, in the laboratory. Author.

118. On the Inheritance of Self-sterility. (Japanese.) Hirosi TERAO. [Idengaku Zassi (Japan. Journ. Genetics) **2** (1923), 141-155]—An account is given of a preliminary investigation on the inheritance of self-sterility in *Petunia violacea*.

When flowers of the self-fertile plant are kept bagged or closed and not hand-pollinated, they remain fruitless very often so that the plant may be mistaken for a self-sterile plant, or else they bear usually much less fruits than when hand-pollinated. This disadvantage for self-fertilization seems to be due mainly to the flower structure in which the pistil is longer than the stamens to the extent that the stigma stands above the level of anthers. Further, the different possibilities of automatic self-pollination are apparently caused by the condition that the relative length of pistil and stamens exhibits some variations among different plants, the stigma and anthers being set quite close in some plants and markedly apart in others. Hence, the selfing experiment for detecting the self-fertile and the self-sterile plants requires hand-pollination.

A self-fertile plant (with white flowers) was crossed with a self-sterile plant (with a different type of white flowers); the former was taken from a family which had been pedigreed through some generations though it still segregated in regard to flower colors and some other characters, and the latter was of an unknown origin. In the selfing experiment with 48 F_1 plants in which the pollination was helped by hand, 23 plants proved self-fertile (flower color: 14 white + 6 very light magenta + 6 light magenta) and 22 plants self-sterile (fl. col.: 10 w. + 6 v. l. m. + 5 l. m. + 2 dark m.)

As some authors have presented evidences for the fact that self-sterility is inheritable as a simple Mendelian recessive to self-fertility, it may well be presumed from the figures above noted that the crossing under consideration would correspond to the mating Ff×ff which should give rise to the F_1 progeny segregating in 1 Ff : 1 ff (F = the factor for self-fertility, f = the recessive allelomorph for self-sterility). The inter-crossing among the F_1 plants which was experimented with 14 self-fertiles and 11 self-steriles gave the results: the matings self-fertile× self-fertile, self-sterile (♀) × self-sterile (♂), and self-sterile (♀) × self-fertile (♂) were fertile almost completely or very highly; among self-steriles there occurred evidently two groups of plants, Group A with 5 plants and Group B with 2 plants, which behaved in inter-crossing in the way that the plants belonging to one and the same group give incompatible matings among themselves while any two plants belonging to different groups respectively present a compatible mating,—the "intra-class sterile" and "inter-class fertile" groups as named by East. These data as a whole seem to suggest that one is probably dealing here with the materially same mode of inheritance as shown in Dr. East's study in *Nicotiana*, to which we owe perhaps the most advanced analysis in the genetics of self-sterility.

Additionally, it may deserve attention that there exists among self-fertile plants marked variations in regard to the intensity of self-fertility, and again that in average the fertility in selfing of self-fertile plants is considerably lower than that of successful inter-crossings. The figures obtained in these connections are summarized in the following table:

	Total no. of the flowers pollinated.	Successful pollination	Average fertility
Selfing :			
Self-sterile .....22 plants	27	1	0.4%
Self-fertile			
Group I (Fertility 11- 18%) ... 4 „	44	6	13.3 „
„ II („ 22- 38 „) ...14 „	182	50	27.5 „
„ III („ 42- 71 „) ... 6 „	59	32	54.2 „
„ IV („ 100 „) ... 2 „	16	16	100.0 „
Total 26	301	104	34.6 „
Inter-crossing :			
Self-fertile ×Self-fertile ... .21 matings	41	40	97.6 „
Self-fertile (♀)×Self-sterile (♂).....30 „	91	86	94.5 „
Self-sterile (♀)×Self-fertile (♂).....25 „	39	30	76.9 „
Self-sterile×Self-sterile			
Group A(♀ or ♂)×Group B(♂or♀)...8 „	20	13	65.0 „
Group A×Group A Group B×Group B } .....22 „	78	0	0.0 „

119. Plant Breeding Experiments with the Opium Poppy. (Japanese). Hirosi TERAO. [Report of the Imperial Hygienic Laboratory, No. **19** (1923), 289-327.]

For the purpose of plant breeding, a number of lines were isolated from certain populations of the opium poppy, *Papaver somniferum*, L., cultivated by practical growers. These lines proved mostly to be practically pure ; this seems to be the consequence of the fact that, in this plant, the occurrence of cross-fertilization is actually rather rare on account of protandry. Among the isolated lines, there were distinguished several types which exhibited respectively very distinctive characteristics in regard to the size and form of capsules, the maturing season, and some other characters relating to the production of opium. Hence it is concluded that the usual method of pure line selection may be applied to ordinary populations of opium poppy quite effectively. Crossings also were experimented among those distinctly different types mentioned above and the resultant F_1 hybrids were tested for practical purpose. The heterosis in these hybrids was generally quite significant, so far as the development of capsules, the growth and maturation of plant, and some other useful characters were concerned.

Author.

120. Über die Vererbung von Funkia ovata. (Japanisch). Yasufusa TERASAWA, [Idengaku Zassi (Japan. Zeits. Vererbungslehre) **2** (1923), 13-21, 1 Abbild.]

Unter den wildwachsenden Individuen von *Funkia ovata* gibt es zwei durch die Blattgrösse zu unterscheidenden Sippen. Sie sind völlig grün und durch Selbstbefruchtung geben nur ihresgleichen.

Eine an der Blattmitte mit mehr oder minder grossen bandartigen weissen Flecken versehene grossblätterige Sippe (Typ I) ist durch Selbstbefruchtung ganz steril. Ebensowenig geben die beiden reziproken Kreuzungen zwischen dieser panachierten Sippe und der wilden

grüren grossblätterigen die Samen. Bei einem anderen Typ, gross- oder kleinblätterig, wobei die Blätter nur am Rande panachiert sind (Typ II) geben die Selbstbefruchtung sowie die Kreuzung mit grüren Pflanzen fast immer nur grüne Nachkommen. Bei einer kleinblätterigen Sippe, wobei die weissen Flecke zeitweise an den Blättern erscheinen (Typ III), gibt die Selbstbefruchtung ausser den grünen Nachkommen eine Anzahl von albinotischen ; durch die Kreuzungen dieser Sippe mit grünen Pflanzen haben wir in einigen Fällen beide grüren und albinotischen Nachkommen und in den anderen ausschliesslich die ersteren. Nach der Verf.'s Ansicht sind alle obengenannten panachierten Sippen als Chimären zu deuten. Bei dem Typ III ist die subepidermale Schicht aus grünen und weissen Zellen zusammengesetzt (Sektorialchimäre). Der Typ II ist eine Periklinalchimäre, wobei alle Zellen der subepidermalen Schicht grün sind, während der Typ I eine dem II ähnliche Periklinalchimäre ist, die wegen der totalen letalen Wirkung ganz steril ist. Verf.

121. Comparative Studies on Cultural Characters of the Three Species of Valsa. (Japanese.) Kogo TOGASHI. [Jour. Soc. Agr. Forest. Sapporo, **15** (1923), 29-38.]

The three species used on the experiment are *V. Mali* MIYABE et YAMADA isolated from *Malus communis, Cytospora chrysosperma* (PERS.) FR. from *Populus nigra* and *V. ambiens* FR. from *Morus bombycis*. These fungi were inoculated on the hard agar media of corn meal, oat meal and apricot-juice containing M/2-M/26 of cane sugar and glucose respectively. The essential data may be summarized as follows :—

1. Among these three fungi, *C. chrysosperma* grew most vigorously on any cultural medium and produced pycnidia most abundantly. These facts tell us that this fungus has the power to utilize the sugars more than the others.

2. *V. Mali* and *C. chrysosperma* had the maximum points of hyphal growth and pycnidial formation on the media of corn meal and oat meal which contain comparatively high concentrations of sugars. *V. ambiens* on the media of corn meal had the maximum point of hyphal growth and pycnidial production on the highest concentrations of sugars, while in the case of oat meal media it had two maximum points on the highest and lowest concentration of sugars.

3. These three fungi took no differences of cultural characters on apricot media, though various degrees of sugars are added. *V. ambiens* could not grow on such a high acidic medium as apricot-juice, even if much sugar was added.

4. On the first part of the cultural experiment, *V. ambiens* changed the media of corn meal and oat meal containing sugars into brilliant purple color. It was the specialized character of the fungus and the phenomena could not found in the case of the other fungi.

5. On any medium, the three fungi used in the experiment had not produced perithecia, three months after inoculation. Author.

122. The Mildew of Blawort. (Japanese.) Kogo TOGASHI. [Engei (Horticulture) **15** (1923), 1-3.]

The occurrence of the mildew of blawort seems to be not yet reported in our country. The fungus is identical to *Bremia Centaureae* SYD. which was recently described by SYDOW in Ann. Myc. **21** (1923), No. 3/4. Author.

123. Ueber einen kurz nach der letzten Feuersbrunst plötzlich entwickelten Schimmelpilz. (Vorläufige Mitteilung). (Japanisch.) Yoshichika TOKUGAWA und Yoshikadzu EMOTO. [Bot. Mag. Tôkyô, **37** (1923), (185)-(193), 1 Tafel.]

Resumee

I. Es ist eine merkwürdige Tatsache, dass kurz nach der auf das letzten Erdbeben folgenden Feuersbrunst auf den verbrannten Bäumen überall ein plötzlich entwickelter Schimmelpilz wahrgenommen wurde. Derselbe ist von einer Art, welche *Monilia aurea* (LINK.) GMEL. und

M. aureo-fulva C. et E. am nächsten steht, und lässt sich folgendermassen spezifizieren: Hyphe lang, 6.5-31.5 μ dick, verzweigt und abgeteilt, emporsteigend, Luftmycel stark entwickelungsfähig, sehr aerobisch, Oidien bildend; Makrokonidien acropetal geformt, elliptisch, rund oder citronenförmig, 4.0-6.5 $\mu \times$ 10.0-12.0 μ; Mikrokonidien elliptisch, 1.5 $\times$ 3 μ; Sklerotien bildend, aber keine Fruchtkörper; Farbe: anfangs grauweiss dann vermehrt sich allmählich die orangegelbe Farbe, schliesslich „orange pink salmon orange" (RIDGWAY: Color standard & nomenclature), saprophytisch.

2. Der Pilz ist gegen gesättigten Wasserdampf von 100°C empfindlich und geht sofort zugrunde; gegen trockene Hitze dagegen ist er widerstandsfähig, und die supramaximale Temperatur ist 130°C.

3. Der Pilz enthält Farbstoffe welche zu der Carotin-Gruppe gehören. (Vgl. Nr. 35-36.— REDAKTION.) Autoref.

124. Mutation and Plant Breeding in regard to the Giant Tobacco. (Japanese.) Hideo TUKADA, Kiyosumi OKADA and Hirosi TERAO. [Idengaku-Zassi (Japan. Jour. Genetics), **2** (1923), 77-93.]

The giant mutant occurring in an indigenous variety of tobacco was tested for the purpose of plant breeding. The mutant type yields twice or thrice as many leaves as ordinary varieties do, but it takes an exceedingly long duration of vegetative growth so that plants of this type attain the flowering stage very seldom in the field. In the crossing between the mutant and an ordinary variety, the giant type behaved as a simple Mendelian recessive to the normal type; the segregation ratio between these two types tends to show considerable deficiencies of the recessive and this is attributed very likely to the fact that the seedling of giant tobacco is apt to be eliminated in the seed bed on account of its slower growth. The giant plant, bearing seeds only occasionally, has been raised yearly through the heterozygote from the crossing mentioned above, and the normal and the giant plants obtained from it were compared with each other in regard to their productivity. The result of this experiment is as follows:

Type	Dry leaves harvested		Value of the leaves		Quality of the leaves	
	lb./acre	Proportion	Yen/acre	Proportion	Yen/lb.	Proportion
Normal	1530	100	843	100	.551	100
Giant	2267	148	1132	134	.499	91

The spontaneous occurrence of giant tobacco is observed occasionally in the indigenous varieties as it has been the case often in the tobaccos of the United States of America, Java, and Sumatra; and corresponding to those giant varieties as Maryland Mammoth, Stewart Cuban, and the like, there is among the leading varieties of Japanese tobaccos a variety, named "Ensyûha," which exhibits every characteristics of the giant type. It is believed to have originated from a single plant selected purposely by a careful grower many years ago, the cultivation of the named variety being limited to the warmer regions of the country. Generally, however, the gigantism seems not to be of much service to the plant breeding in tobacco so long as it is associated with the late maturing habit of plant. Nevertheless, the F_1 hybrid between the giant type and ordinary varieties may be of some practical use, since, according to the authors' computation with those figures which were obtained by LODEWIJKS for the uniformly normal and

the segregating families regarding the giant tobacco, the heterozygote concerned bears about 20% more leaves than the dominant homozygote while the former matures but a little later than the latter. Authors.

125. Experiments on the Breeding and Heredity of Sweet-potato. (Japanese.) Utakiti WADA. [Idengaku Zassi (Japan. Jour. Genetics) **2** (1923), 137-144.]

Sweet-potato produces flowers very rarely in Japan proper, while in Loochoo Islands where the author has made his experiments it bears flowers very commonly every year during November and December. Fruits are however very sparingly produced, though there is some variation according to different races. The author has performed artificially the self-fertilisation of fifty races in all, and found that among them 2/3 does not bear fruits at all (*self-sterile*), while of the remaining some have produced 1-5 fruits per 100 flowers when artificially fertilised, and some others 20-30 ; still in some others almost 50% may be produced.

The following cross-fertilisations were made.

1. Cross between two self-sterile races or between a self-sterile on the one side and an almost self-sterile race on the other. No fruits are produced.

2. Cross between a self-sterile and a self-fertile race in both reciprocal ways. Fruits are formed, and the higher the fructification rate of the fertile race by selfing, the larger that by the cross.

3. Cross between two self-fertile races. If the fructification rate by selfing is larger in the one than in the other that by the cross will be considerably heightened. On the contrary, the author has found in some cases that the cross of two self-fertile races ends in the entire sterility or in a very low fertility.

The stem colour is either green or red, the skin colour of the tuber is either white or red, while its flesh colour is either white or yellow. According to the author's experiments which are not yet brought to complete end it may be said that green stem, white skin and white flesh are dominant to red stem, red skin and yellow flesh respectively, and that the segregation takes place according to the scheme either 3:1 or 15:1. Author.

126. Über das Erscheinen von Anomalien bei Reispflanzen. (Japanisch.) Morimasa YAMASAKI. [Idengaku Zassi (Japan. Zeits. Vererbungslehre) **2** (1623), 31-38, 3 Abbild].

Unter den im Pflanzenreich zu beobachtenden Anomalien gibt es einige, die künstlich in ihrem Erscheinen verhindert werden können. So z. B. bei Reispflanzen haben wir eine anomale durch den japanischen Namen „Moture" bekannten Sippe, wobei die Halmen sich nach unten biegen, während sie normal aufrecht stehen. Wenn man solche anomale Sippe im nährstoffarmen Boden kultiviert, sieht man, dass die Anomalie nur im Beginn der Entwicklung nachzuweisen ist und bald verschwindet. Ein anderes Beispiel ist bei einer Reissippe zu sehen, wobei die Blätter mit einer Anzahl von braunen Flecken versehen sind ; diese Anomalie kann auch durch die Kultur im nährstoffarmen Boden usw. zum allmählichen Verschwinden gebracht werden.

Auch gibt es eine Sippe, die durch die purpurne Farbe der Halmen, Blätter usw. ausgezeichnet ist, was zum in den Oberhautzellen enthaltenen Anthozyan zu verdanken ist. Bei der Kultur unter dem ungenügenden Lichte sieht diese Sippe ganz grün aus, wie bei der normalen, ausgenommen dem schwach purpurnen Keimblatt.

Wenn man die Reispflanzen im Warmhause kultiviert, bemerkt man bei vielen Varietäten die Blütenanomalien, welche niemals in der Natur vorkommen werden, so z. B. die Vergrösserung von Hüllspelzen sowie von gewöhnlich sehr winzigen Hüllspelzenrudimenten. Wenn die Hüllspelzen sich so stark vergrössern, dass sie der Deckspelze gleichgross werden, so verkleinert sich die Vorspelze, die oft sich zu 2-3 schmalen Stückchen spaltet, ja sogar nicht selten ganz

verschwindet. In vielen Fällen sieht man auch oft bei einer Blüte 2-3 Pistillen und 7-9 Staubblätter, was bei den sterilen Pflanzen zu beobachten ist.

Der Verf. erwähnt noch eine andere Anomalie, welche darin besteht, dass der Halm nahe dem Boden sich verzweigt, diese Anomalie wurde nur bei Kultur im Warmhause beobachtet, niemals in der Natur.

Weiter erwähnt Verf. kurz einige Beispiele von Anomalien, die durch die Umgebung nicht beeinflussbar sind. Verfasser.

127. Zwei neue Arten von Polystictus. Atsushi YASUDA, [Bot. Mag. Tôkyô **36** (1922), 154-157, 3 Abbild.]

Polystictus gypseus und *orientalis* sind geschrieben und abgebildet. S. Ikeno.

128. Neue Arten von Stereum und Hymenochaete. Atsushi YASUDA. [Bot. Mag. Tôkyô **37** (1923), 60-61, 2 Abbild.].

Stereum japonicum und *Hymenochaete boninensis* sind geschrieben und abgebildet. S. Ikeno.

129. Eine neue Art von Hypoxylon. Atsushi YASUDA. [Bot. Mag. Tokyo **37** (1623), 67-68, 1 Abbild.]

Hypoxylon viride wird geschrieben und abgebildet. S. Ikeno.

130. Zwei neue Arten von Trametes. Atsushi YASUDA. [Bot. Mag. Tôkyô **37** (1923), 83-85, 3 Abbild.]

Trametes sendaiensis und *symploci* sind geschrieben und abgebildet. S. Ikeno.

131. Vier neue Arten der Basidiomyceten. Atsushi YASUDA. [Bot. Mag. Tôkyô **37** (1923), 125-130, 5 Textabbild.]

Stereum roseum, Polyporus (*Amaprodermus*) *sendaiensis, Daedalea Dickinsii* und *Lycoperdon bispinosum* sind geschrieben und abgebildet. S. Ikeno.

132. Ueber einen Ursprung des Stickstoffes bei Cycas revoluta. (Japanisch.) Kiyohisa YOSHIMURA. [Wissenschaftl. Mitteil. aus der land- und forstw. Hochschule in Kagoshima **5** (1922), 35-39, 1 Textabbild.]

Cycas revoluta kann im sehr nährstoffarmen Boden ohne besondere Stickstoffdüngung gut gedeihen, doch ist ihr Stickstoffgehalt in Stamm, Blatt und Samen nicht viel kleiner als bei vielen Leguminosen. Der Verf. hat seine Aufmerksamkeit auf die in ihren Wurzeln schmarotzenden Cyanophyceart, *Anabaena Cycadearum* zugewendet und gefunden, dass der N-Gehalt pro 100 Teilen Trockensubstanz bei den Wurzeln, die von *Anabaena* frei sind and bei denselben, wobei dieser Organismus wohnt, 1,836% resp. 3,550% beträgt; auch bei den Blättern beträgt der N-Gehalt bei beiden 0,584% resp. 0,605%. Die weiteren Experimente, die sich auf Stämme, Blätter und Wurzeln von *Anabaena*-freien und -besitzenden Pflanzen beziehen, haben inbezug auf ihren N-Gehalt im ganzen das Verhältnis 100:271 angezeigt.

Aus Alledem schliesst der Verf. auf die Aufnahmefähigkeit des freien Luftstickstoffes durch *Cycas revoluta* mit der Beteiligung von *Anabaena*. Verfasser.

133. Beiträge zur Kenntniss der stickstoffhaltigen Bestandteile der Früchte der Chayote (Hayatouri). Kiyohisa YOSHIMURA. [Jour. Biochem. Tokyo **1** (1922), 347-351.]

Abstracts 134 - 196

(Referring to the principal papers on Botany and allied subjects which have appeared in Japan mostly during April—December 1924.)

134. Ueber die Häufigkeit der spontanen Kreuzbefruchtung und ihre Ursache bei Reispflanze. (Japanisch). Masao AKEMINE und Seisuke NAKAMURA. [Mitteil. aus landw. u. forstw. Ges. Sapporo **16** (1924), 1-36.]

Um die Tatsache kennen zu lernen, wie häufig die spontane Kreuzbefruchtung bei Reispflanze stattfinden wird, haben die Verfasser verschiedene Reissippen nebeneinander kultiviert. Die während fünf Jahre an mehr als 100 000 Stöcken gemachten Beobachtungen haben es gezeigt, dass die Häufigkeit der Kreuzbefruchtung 0,165-1,669 % und im Mittel 0,703 % beträgt, ausserdem wurde es nicht selten nachgewiesen, dass gar keine Kreuzbefruchtung erfolgt ist. Bemerkt sei noch, dass diese Häufigkeitszahl nur sich auf die Kreuzung zwischen verschiedenen Sippen, welche nebeneinander kultiviert sind, bezieht, und deshalb wenn man alle sonstigen Kreuzbefruchtungen (z. B. zwischen zwei zu ein und derselben Sippe gehörenden Individuen usw.) in Betracht zieht, mag diese Zahl am wenigsten 3% betragen.

Die Häufigkeit der Kreuzbefruchtung ist nach den Jahren und Sippen variabel. Der letztere Vorgang kann nur erfolgen, wenn beim Blütenöffnen die Antheren im geschlossenen Zustande bleiben, was teils der Sippeneigentümlichkeiten, teils den Aussenbedingungen zuzuschreiben ist. So z. B. führen sowohl niedere Temperatur als höhere Feuchtigkeit zur Zunahme solcher Blüten und dementsprechend zur Erhöhung der Häufigkeit der Kreuzbefruchtung. Auch bei den Sippen, wobei als allgemeines Regel beim Blütenöffnen die Antheren geschlossen bleiben, erhöhen Trockenheit und höhere Temperatur ihre Häufigkeit. S. Ikeno.

135. An Experiment on the Promotion of Plant Growth by the Influence of Electric Light. (Japanese). Keijirô ASÔ and Umejirô MURAI. [Jour. Scient. Agric. Soc. **254** (1924), 31-36, 4 figs.]

The culture experiments were made on barleys and peas to test, whether their growth will be appreciably promoted by the action of electric light, without increasing the quantity of carbonic acid gas. Plants were illuminated during night by the electric light of 100 candles power. It was found that 1. the growth is much quicker in them than in the control- plants, 2. the development of inflorescences takes place much earlier, and 3. the length and weight of different parts are much larger. Authors.

136. Ueber die Chromosomenzahl von Secale cereale L. Kazuo GOTOH. [Bot. Mag. Tôkyô, **38** (1924), 135-151, 13 Textabb.]

Es gibt bei Roggenpflanzen neben den typischen 7-chromosomigen Individuen bisweilen dieselben mit 8 bzw. 16 Chromosomen. Bei den 8-chromosomigen verhalten sich zwei homologe Chromosomen in der hetero- und homöotypischen Kernteilung der Pollenmutterzellen sehr oft in vielen Beziehungen verschieden von den 14 anderen. Die Versuchsresultate haben es gezeigt, dass der 8-chromosige Roggen aus dem 7-chromosomigen entstanden ist, indem zwei von 14 Chromosomen bei dem letzteren je zu zwei quergeteilt werden, welche nichts anderes sind als zwei in Rede stehenden spezifische Chromosomen.

137. Un simple Moyen d'isoler le Monascus purpureus de l'Ankâ etc. (En japonais). Syôzi HAGIWARA. [Report Dept. Industry, Governm. Research. Inst. Formosa **5** (1924), 3 p.]

L'isolement du *Monascus purpureus* WENT de l'Ankâ qu'on sert à la fabrication d'une liqueur spiritueuse appelée "Antyû," "Kattyen" ou "Kakkon" en Formose n'est guère facile. Voici un simple moyen pour celà: une fiole de 50 cm. cubes, remplie de 5 gr. de riz et 6 cm. cubes de l'eau, est complètement stérilisée, et on y ajoute 10 cm. cubes d'alcool à 26–28% (volume) et 1–2 gr. d'Ankâ. A la température de 30°–35°C le *Monascus* se présente après quelques jours sous la forme d'un voile rouge sombre et alors peut être facilement isolé. Auteur.

138. Influence des Sels métalliques sur la Couleur du Monascus purpureus Went. (En japonais). Syôzi HAGIWARA. [Report Dept. Industry, Governm. Research Inst. Formosa **5** (1924), 5 p.]

Si l'on ajoute à une culture pure du *Monascus purpureus* une minime quantité du sel d'arsenic, d'antimoine ou de zinc on apercevra bientôt l'apparition des filaments d'une belle couleur rouge foncée, tandis que par l'addition du sel d'étain ils seront d'une couleur orange rougeâtre sombre. Auteur.

139. Recherches des Diastases chez l'Ankâ et le Monascus purpureus. (En japonais). Syôzi HAGIWARA et Naosi AOYAMA. [Report Dept. Industry, Governm. Research Inst., Formosa **5** (1924), 43.].

En cultivant l'Ankâ de Formose et de Chine à la température de 37–38°C, on a pu y trouver les diastases suivantes: l'amylase, l'émulsine, la peroxydase et le labferment; ni la lipase, ni l'uréase, ni la peptase, ni l'oxydase n'y ont été trouvées. La présence de la trypsine et de la protéase est douteuse. Dans une culture tenue à la température de 38–39°C on a pu trouver l'amylase, la maltase, l'émulsine, la peroxydase, et le labferment; la lipase, l'uréase, la protéase, la peptase et l'oxydase n'y se trouvaient point.

Auteurs.

140. On the Inheritance of the Fasciation in the Japanese Morning Glory. (Japanese). Tokio HAGIWARA. [Jour. Scient. Agric. Soc. **355** (1924), 54–63, 1 fig.].

The cross between the Morning Glory with normal and that with fasciated stems has given in F_1 normal plants and in F_2 94 normal and 7 fasciated offspring. The author's conclusion is that the fasciation is due to the cooperation of the two recessive genes **f'** and **p**, the latter alone causing the so-called the "kuzyaku" (peacock)-shaped leaf of the gardeners. In addition, the linkage relation between the gene **f'** and some others was noticed. S. I.

141. Genetic Studies of Leaf-Characters in Morning Glories I. On the Complementary Factors concerning the "Udu"-Character. (Japanese). Tokio HAGIWARA [Bot. Mag. Tôkyô **38** (1924), (277)–(290), 3 figs.].

Among the contracted varieties known by the general name "Udu" there are three strains, viz. "uduba-udu", dwarf-"udu", and semi-"udu".

In "uduba-udu" leaves are amplexicaul. The strain is recessive to the normal.

In dwarf-"udu", though leaves are normal, the internodes are short and the stem does not twine. Recessive to the normal strain.

In semi-"udu" leaves appear to be intermediate between normal and amplexicaul ones. Also recessive to the normal strain.

The hybridisation between dwarf-"udu" and "uduba-udu" gives rise to reversionary normale plants. In the next generation, each of the latter segregates into normal:

contracted in the ratio 9: 7, which indicates that the factors concerning these two "udu"-strains are complementary. It must be noticed that the contracted plants which are segregated out in F_2 contain not only "uduba-udu" and dwarf-"udu", but also plants which are only 2–3 inches high, i. e. one of the smallest strains of Morning Glories.

S. I.

142. Sex Reversal in Hemp. (Preliminary Report). (Japanese). Kenji HIRATA. [Jour. Agric. Forest Soc. Sapporo **16** (1924), 37–60, 1 pl. and 1 fig.]

It was confirmed that the sex-ratio in hemp is not decisively influenced by the color, maturity or weight of the seed, as well as the fertility of the soil. But the preponderance of females was observed in every plot, although the proportion fluctuated more or less considerably.

The haploid chromosome number is 10 and the diploid 20, as shown by STRASBURGER. In two varieties Tochigi and Karafuto the mitotic figures are analogous with each other. In the former, however, minute investigations have shown that one chromosome pair whose members are different from each other and are united, so as to resemble somewhat the figure 3, appears in the metaphase of the reduction division in the pollen mother-cells, as it is the case in *Melandrium album* (K. B. BLACKBURN and Ö. WINGE).

In the variety Karafuto, about 50 % of both male and female plants have reversed their sexual expression through the mutilation caused by the removal of certain parts of their branches and stems at the early stage of flowering. But in the variety Tochigi, the rate of sex reversal was extremely low under the same treatment. Several out- and inbreedings were tried with the sex-reversed plants of the Karafuto.

The author has proposed a hypothesis about the chromosome mechanism of the hemp which will explain the sex reversal above described.

143. On the Flax Anthracnose and its Causal Fungus, Colletotrichum Lini (Westerdijk) Tochinai. Makoto HIURA. [Japan Jour. Bot. **2** (1924), 113–132, 1 pl and 3 figs.]

144. On the Root-neck Blight of the Vines near Sapporo. (Japanese). Makoto HIURA. [Jour. Agric. Forest. Soc. Sapporo **16** (1924), 63–78, 3 figs.]

Some vine-dressers in Sapporo (Hokkaidô) have often complained of the trouble of the Vine, which was referred formerly to cold injury. According to the author's investigations the trouble is a disease caused by a parasitic fungus which seems to be identical with the "dead-arm" in America, though it is not so serious in Sapporo as in the latter country. The author could not find the *Cryptosporella* stage of the fungus, but only its *Fusicoccum* stage. Berries were never attacked, while the basal part of the stem is highly injured, so that the author calls the disease by the name "root-neck blight". The application of lime sulphur wash in spring is very effective.

145. Revisio Graminum Japoniae V. Masaji HONDA. [Bot. Mag., Tôkyô, **38** (1924), 119–129.]

The generic name *Syntherisma* being right to be adopted in place of *Digitaria*, I have reported the following *Syntherisma*-species of our country.

Syntherisma sanguinalis, (LINNÉ) DULAC
var. *ciliaris*, (RETZIUS) HONDA
var. *multinervis*, HONDA var. nov.
var. *evalvula*, HONDA var. nov.
Syntherisma formosana, (RENDLE) HONDA
var. *hirsuta*, HONDA var. nov.
Syntherisma platycarpha, (TRINIUS) HONDA

Syntherisma barbata, (Willdenow) Nash
Syntherisma longiflora, (Retzius) Skeels
Syntherisma Ischaemum, (Schreber) Nash
var. *lasiophylla,* Honda var. nov.
Syntherisma filiformis, (Linné) Nash
Syntherisma Henryi, (Rendle) Honda
Syntherisma sericea, Honda sp. nov.
Syntherisma Hayatae, Honda sp. nov.
var. *magna,* Honda var. nov.

In this paper, moreover, *Ichnanthus axillaris,* (Nees) Hitchcock et Chase has been reported as a new plant to the Japanese flora, and the scientific name *Coridochloa semialata,* Nees (var. *typica* and *ambigua,* Honda) has been adopted by me, being thought better than *Panicum semi-alatum,* R. Brown or *Axonopus semi-alatus,* J. D. Hooker.

Author.

146. Revisio Graminum Japoniae VI. Masaji HONDA. [Bot. Mag., Tôkyô, **38** (1924), 189–201.]

This article contains two genera, *Oplismenus* and *Chaetochloa* (*Setaria* of many authors), which are divided as follows:—

Oplismenus japonicus, (Steudel) Honda
Oplismenus imbecillis var. *morrisonensis,* Honda var. nov.
Oplismenus Burmanni var. *intermedius,* Honda var. nov.
Chaetochloa chondrachne, (Steudel) Honda
Chaetochloa rariflora, (Mikan) Hitchcock et Chase
Chaetochloa lutescens, (Weigel) Stuntz.
α. genuina, Honda var. nov.
β. longispica. Honda var. nov.
Chaetochloa viridis, (Linné) Scribner
α. genuina, Honda var. nov.
β. purpurascens, (Hupboldt, Bonpland et Kunth) Honda
γ. pachystachys, (Franchet et Savatier) Honda
subvar. a. *typica,* Honda subv. nov.
subvar. b. *lanceolata,* (Hackel) Honda
subvar. c. *linearia,* Honda subv. nov.
Chaetochloa gigantea, (Franchet et Savatier) Honda
α. genuina, Honda var. nov.
β. pilosa, Honda var. nov.
γ. furcata, Honda var. nov.
Chaetochloa italica, (Linné) Scribner
var. *germanica,* (Miller) Scribner

Author.

147. Ein Vererbungsversuch über die Grannen bei Gerste. Seiitirô IKENO, [Japan. Jour. Bot. **2** (1924), 189–207, 3 Taf.]

148. Genetic Studies in Morning Glories XII–XIV. (Japanese.) Yoshitaka IMAI. [Bot. Mag. Tôkyô **38** (1924), (127)–(142), (185)–(220), (233)–(242), with figs.]

A certain number of Mendelian factors concerning the leaf character, and some cases of mutations and linkages are described.

149. On the Phylogeny of the Rhodophyceae. (Japanese). Mitsuharu ISHIKAWA. [Bot. Mag. Tôkyô **38** (1924), (159)–(167).]

In this paper the writer's view on the phylogeny of the Rhodophyceae which was sometime ago published [s. Japan. Jour. Bot. 1 (1923), (207), entry 47] is given again in some detail and several evidences favouring his view are added.

His cytological studies on *Prasiola* on the one hand and some Bangiales, as *Porphyra*, *Bangia*, *Porphyridium* on the other have shown him that all of them are in perfect accord as regards the presence of the incipient nucleus, stellate chromatophore and aplanospore. The Schizogoniales (incl. *Prasiola*) may indeed be regarded as the Bangiales devoid of phycocyanin and phycoerythrin, which have perhaps disappeared in the course of the phylogenetic evolution. On the contrary, *Enteremorpha* which possesses the differentiated nucleus and discoidal chromatophore and produces motile cells (zoospores and planogametes) has evidently no phylogenetic connection with the Bangiales and must be ranked among the Chlorophyceae. In other words, there exists no connecting link between the latter and the Rhodophyceae.

When *Thorea* and *Compsopogon* are studied cytologically it will be found that both lack the prevailing characters of the Bangiales, viz. the incipient nucleus and the stellate chromatophore. They must not be ranked among the Bangiales, as usually done: *Thorea* is closely allied to the Helminthocladiaceae or Chaetangiaceae, while *Compsopogon* should be placed among the Lemaneaceae.

The author's general conclusion is: the Florideae must have been descended from the Cyanophyceae through the Bangiales. No connecting link between the Cyano-Rhodophyceae and the Flagello-Chlorophyceae lines does exist. The members of the former line are distinguished by their containing phycocyanin or phycoerythrin as well as by their lacking ciliate motile cells characterizing the Flagellata, Chlorophyceae and Phaeophyceae. Author.

150. De nova Asari Species ex Japonica australi. Tokutaro ITO. [The Science Reports Tohoku Imp. Univ. 4th Ser. 1 (1924), 45-46, 1 pl.]

A Latin description of a new species, *Asarum Fudsinoi* from Southern Japan. Illustrated.

151. The Flowering Habit and Natural Crossing in the Egg-plant. Yôiti KAKIZAKI. [Japan. Jour. Genetics 3 (1924), 29–38, 2 figs.]

In normal flowers of *Solanum Melongena* the anthers form together a cone around the style, and the stigma projects out beyond it, hence the body of the visiting insect comes first of all in contact with the stigma. Owing chiefly to this flower construction the natural crossing is very frequent and this was proved by some culture experiments. When a black-typed plant (skin of unripe fruits and the vegetative part black) is crossed by a white-typed one, the F_1-plant is black and the F_2-offspring are composed of 3 black and 1 white. For the experiment the two types were mixplanted in one field, and the seeds taken from the white type have given rise in the next year to 6.75% black offspring, which is naturally due to the cross-fertilization white × black. When each flower is considered separately, it will be seen that the number of hybrid seeds from each is 0.2–46.8%, and in most cases under 10%. In a total of 63 flowers examined no one which has produced no hybrid seeds at all was found. Flowers emasculated and left to natural pollination did not bear fruits but very rarely, nor did plants placed in a net-house to prevent the visit of insects produce many fruits. Author.

152. Identification of Philippine Woods by Anatomical Characters. Supplement to the Anatomical Characters and Identification of Formosan Woods, etc. Ryôzô

KANEHIRA. [Report Dept. Forestry, Governm. Research Inst., Formosa **2** (1924), (1)–(73), 2. pls].

The number of species of Philippine woods, of which the anatomical characters were examined, is 155 in all: 41 families and 108 genera of the Dicotyledons, 4 genera and 5 species of the Gymnosperms.

Part I (1–53) contains the description of the anatomical characters of each species, and Part II (54–62) the analytical key according to the anatomical characters, while Part III (63–70) gives a summary of the whole work. An index of species names (71–73) is given. The plates give the photographs of wood-sections of 12 species. Author.

153. Anatomical Notes on Indian Woods. Ryôzô KANEHIRA. [Bull. Dept. Forestry, Taihoku, Governm. of Formosa. **4** (1924), (1)–(40), 1 pl].

Long ere since various ornamental woods have been imported from India to Japan, and are known here under the Japanese name "Karaki", such as some species of *Pterocarpus, Diospyros, Cassia,* etc. The author has examined the anatomical characters, of a number of such woods, partly in order to compare them with those of Formosan ones formerly studied by him, and partly to make some contributions towards the identification of various woods known under the name "Karaki." Part I (1–21) contains the description of the anatomical characters of 105 species belonging to 34 families and 76 genera, dicotyledonous as well as gymnospermous. Part II (22–28) gives an analytical key of all species according to their respective anatomical charaters, and Part III the literature (29–33). An index of species examined is given. The plate illustrates wood-sections of some few species. Author.

154. On the Origin of Japanese Pears and the Inheritance of the Skin Colours of their Fruits. (Japanese). Akio KIKUTI. [Japan. Jour. Genetics **3** (1924), 1–21, 5 figs.] Though in Japan there are several native species of *Pyrus,* the cultivated varieties of Japanese pears are derived from *P. serotina* REHDER, native to Middle and Southern China, the varieties of the latter strain being also cultivated in these regions. Those grown in Northern China and Manchuria are believed to have originated from *P. ussuriensis* MAX., *P. ussuriensis* var. *ovoidea* REHDER, or *P. Bretschneiderii* REHDER, of which the two former are the principal sources of the modern Korean varieties.

The skin colour of Japanese varieties of pears belongs to either of the three types, russet, green and intermediate, i. e. green imperfectly covered with russet. For the inheritance of skin-colour the following factors are responsible. **R** and **r** are for russet and green respectively; the zygote **Rr** is russet, yet much weaker in its colour-intensity than **RR**, and though it remains russet under humid condition, it changes to intermediate under dry condition. **RR** remains always russet. In the presence of another factor **M**, **Rr** remains russet, but in its absence it becomes intermediate. The genetical constitutions of the phenotypes in regard to the skin-colour of the fruit are consequently as follows:

1. Russet:
   a. Constant russet—**RRMM, RRMm.** and **RRmm;**
   b. Modifiable russet—**RrMM** and **RrMm.**
2. Intermediate—**Rrmm.**
3. Green—**rrMM, rrMm,** and **rrmm.**

Author.

155. Contributiones ad Cognitionem Florae Asiae Orientalis. XII. Gen'iti KOIDZUMI. [Bot. Mag. Tokyo, **38** (1924), 87–113.

Entries 153—155

The author in continuation of his studies of the eastern asiatic flora, has described the following 26 new species and a new genus.

Brachycyrtis, a new genus of Liliaceae is established.

Pyrus sohayakiensis Koidz., *P. Zensukeana* Koidz., *P. kiusiana* Koidz., *P. squarrosa* Koidz., *P. mikado* Koidz., *P. tambana* Koidz., *P. yamatensis* Koidz., *Fraxinus satsumana* Koidz., *Cirsium Babanum* Koidz., *Taraxacum japonicum* Koidz., *Myriactis japonensis* Koidz., *Lycoris albiflora* Koidz., *Prunus alpina* Koidz., *Tricyrtis Bakerii* Koidz., *Lycium griceolum* Koidz., *Diplazium boninense* Koidz., *Dryopteris jessoensis* Koidz., *Trichomanes boninense* Koidz., *Diplazium Christensenianum* Koidz., *D. lutchuense* Koidz., *Dryopteris taituenses* Koidz., *D. sacrosancta* Koidz., *D. elegans* Koidz., *D. boninensis* Kodama, apd. Koidz., *Athyrium regulare* Koidz., *Pinus amamiana* Koidz.

156. Ueber Zuckerbestimmung mittels des „Verdünnungsverfahrens". Riichiro KÔKETSU. [Japan. Jour. Bot. **2** (1924), 71–74].

157. Ueber den Gehalt an Trockensubstanz und Asche in einem bestimmteu Volumen Gewebepulver als Indizium für den Gehalt des Pflanzenkörpers an denselben Konstituenten. Riichiro KÔKETSU. [Jour. Dept. Agric. Kyushu Imp. Univ. **1** (1924), 151–162].

Der Trockensubstanz- und der Aschengehalt eines Pflanzenkörpers können, je nach den Umständen, mit dem durchschnittlichen absoluten Gehalt in einem Körperindividuums, in einer Flächeneinheit, oder in einer Gewebevolumeneinheit, oder auch durch den Gehalt in Prozenten des Gesamt- oder Trockengewichtes angegeben werden. Aber die Frage, welche Methode in einem gegebenen Falle die zweckmässigste sei, ist nicht leicht zu entscheiden. Selbst wenn ein Bestimmungsverfahren fehlerlos ausgeführt wird, so dürfte es doch häufig nicht möglich sein, eine biologisch zweckdienliche Deutung aus den Versuchsresultaten zu ziehen, da insbesondere bei lebenden Versuchsmaterialien, durch verschiedene Faktoren Fehlerquellen verursacht werden können. Ja, es kommt wohl nicht selten vor, dass die Resultate einer quantitativen Bestimmung eines Stoffes, je nachdem man sie in Proz. des Frischgewichtes oder des Trockengewichtes ausdrückt, sich geradezu umgekehrt verhalten.

Um einen solchen Irrtum in der Beurteiling der Deutung von quantitativen Bestimmungsresultaten möglichst zu verringern, versuchte der Verfasser den Stoffgehalt eines Pflanzenkörpers durch die Bestimmung des Gehaltes in einem bestimmten Volumen Gewebepulver zu beurteilen. Zur Herstellung des Gewebepulvers wurde das zuerst in einem Trockenschrank wasserfrei gemachte Material fein pulverisiert und durch 2.5 mm Sieb gesiebt. Ein kleiner Messzylinder von ca. 1 cm Durchmesser wurde zur Messung des Pulvervolumens benutzt, indem der dabei kaum vermeidliche Messungsfehler dadurch vermindert wurde, dass der Verfasser den Messzylinder mit dem Gewebepulver von einer bestimmten Höhe (2 cm) senkrecht auf dem Tisch fallen lies, bis die Verminderung des Volumens nicht mehr merklich war.

Nach einer Reihe von Versuchen wurde es gut bewiesen, dass diese „Pulvermethode" für die Bestimmung des Trockengewichtes und des Aschengehaltes in einem Pflanzenkörper zweckmässig war, insbesondere bei solchen Fällen, wo die zu untersuchenden Materialien in ihrer stofflichen Zusammensetzung weit voneinander abweichen, ein Ergebnis, welches ein grosses Anwendungsgebiet dieser Methode, sowohl in der Physiologie als auch in der Oekologie hinwies. Autor.

158. Ueber die abnormale Kernteilung in den Wurzelspitzen von Vicia faba. Hideo KOMURO. [Bot. Mag. Tôkyô **38** (1924), 115–117, 7 Abbild.]

Entries 156—158

Eine Beobachtung über die fixierten und gefärbten Wurzelspitzenpräparaten aus einer „Hyôgô-Rasse" von *Vicia faba* wird wie folgt beschrieben: Zuerst teilt das Kernkörperchen zu zwei, wonach die Kernsubstanzen um jedes desselben hingehen; eine Scheidewand entsteht und damit wird der Kern zu zwei Tochterkernen geteilt ohne zuvorige Chromosomendifferenzierung. Die Beobachtung geschah an den Zellen des Zentralzylinders. S. Ikeno.

159. Die Kerne und ihre Chromosomen in den Wurzelspitzen von Trillium. (Japanisch). Hideo KOMURO. [Bot. Mag. Tôkyô **38** (1924), (171)–(174).]

Die Chromosomenstruktur wurde bei den Wurzelspitzen von *Trillium grandiflorum* studiert. Die Fixierung geschah nach der Methode von FLEMMING, BOUIN-ALLM und MERKEL, von denen die letzte als die vorzüglichste sich erwiesen hat. Im ruhenden Kerne wird die chromatische Substanz homogen verteilt und mit 3–4 Nukleolen versehen. Bei der Interkinese werden die Kernsegmenten alveolär, während das Knäuel gar keine solche Struktur erkennen lässt. In der frühen Anaphase sehen wir die vakuolisierte Struktur nur bei den BOUIN-ALLMschen Präparaten, nicht aber bei den MERKELschen. In der späten Anaphase und Telophase werden sie etwas alveolär. Der Verf. kommt zum Schlusse, dass die alveoläre und vakuolisierte Struktur der Chromosomen hauptsächlich von der Art des Fixierungsmittels abhängig ist. Nach der Verf.'s Ansicht müssen bei der Fixieruug die folgenden Bedingungen in Betracht gezogen werden, 1. die Natur und die Temperatur des Fixierungsmittels, 2. sein PH-Wert, 3. die Natur des für seine Darstellung gebrauchten destillierten Wassers, und 4. die Zeit und Temperatur der Fixierung. S. Ikeno.

160. The Cells of Vicia faba Modified by Röntgen Rays, and Their Resemblance to Maligŋant Tumour Cells with the Cytological Observations of Tumours. Hideo KOMURO. [Japan. Jour. Bot. **2** (1924), 133–156, 2 pls. and 12 figs.]

161. Report on the Vegetation of Northern Saghalien. (Japanese). Yûshun KUDÔ. [Published by the Military Administration of the Saghalien Expeditionary Force of Japan. Alexandrowsk, Saghalien, (1923). 1–295, 1 map and 17 plates].

The present report embodies important information relative to the flora of Northern Saghalien, which has accrued during the past 56 years, since the publication of FR. SCHMIDT's "Reisen im Amurlande und auf der Insel Sachalin" in 1868. The report is preceeded by a historical sketch and a bibliography of 226 titles. The vegetation is characterized by the deciduous coniferous forest of *Larix dahurica* TURCZ. var. *kamtschatica* MIYABE et KUDO and by the presence of Saghalien tundra. The *Larix* forest occupies a large tract of country and is most typically developed in the northern part. The Saghalien tundra is not always sharply divided from the *Larix* forest vegetation; numerous undershrubs are often mixed with it. Fir and Spruce (*Abies sachalinensis* and *Picea jezoensis*) forests are also extensive, but occur in the south and south-western parts. A systematic enumeration is designed to give all the species of vascular plants known to grow without cultivation, in Northern Saghalien. The sequence of families is that of ENGLER; it begins with ferns and ends with Compositae. The flora contains according to our present knowledge 594 species, representing 292 genera and 80 families. From the phytogeographical point of view, the author supports the divisions suggested by FR. SCHMIDT. And he points out that the flora of northern and eastern parts is related to that of Siberia, while the flora of south-western part is related to that of Southern Saghalien and Hokkaido. A list of the useful plants of Northern Saghalien is given with the directions for uses. Author.

162. On the Spermatozoid of Sargassum. (Japanese). Hiroshi KUNIEDA. [Report of the Fishery Society **4** (1924), 93-96, 2 figs., also Bot. Mag. Tôkyô, **38** (1924), (291)-(293), 3 figs.]

The spermatozoid of *Sargassum Horneri* was several times observed by the author. Its body is slender and provided with two cilia directed in opposite directions and laterally inserted, of which each measures nearly twice its length. When the antheridia protrude out from the conceptacle and are adhering to the surface of the receptacle, being enveloped by the mucilage, the spermatozoids therein begin to move, and after being liberated from them, make active motion. As the author was able to observe many actively moving spermatozoids around the oogonia out of the conceptacle and attached to the surface of the receptacle by the mucilage enveloping them, it is evident, that the fertilization will take place towards that time. Author.

163. Botanische Betrachtungen über experimentelle Zellphysiologie. Ernst KUSTER. [Japan.-Deutsche Zeitsch. f Wiss. u. Technik **2** (1924), 109-114].

Für das Studium der Zellphysiologie empfehlen sich viele Pflanzenzellen durch ihre Grösse, z.B. die Zellen der Schlauchalgen (wie *Caulerpa, Bryopsis, Valonia, Derbesia, Vaucheria*) sowie der Algenpilze, aber zugleich bieten sie dafür viele Schwierigkeiten, welche besonders davon herrühren, dass jede Pflanzenzelle gewöhnlich eine feste Zellulosehülle hat. Die Methoden der experimentellen Zellphysiologie sind die Plasmolyse, die Zentrifuge, die mechanische Zertrümmerung und die Behandlung mit Giften. Zum Schlusse sind einige bisher bekommenen Ergebnisse sowie einige zukünftigen Aufgaben der experimentellen Zellphysiologie erwähnt. S. Ikeno.

164. On the Flowering Habit of Chrysanthemum littorale Maekawa, its Vegetative Propagation as an Adaptation, the Fluctuation of the Number of Ligulate Flowers, and the Cultivated Races Derived from it. (Japanese). Tokujiro MAEKAWA. [Journ. Agric. Forest. Soc. Sapporo **14** (1923), 1-16, 1 pl. and 4 figs.; **16** (1924), 61-86, 2 pls. and 7 figs.]

Chrysanthemum Gmelini (LEDEB.) MIYAKE et MIYAKE which was first described and illustrated by GMELIN must be considered as a species quite distinct from *C. arcticum* L., though the two are sometimes confounded together. In Kurile Isl. there occur not only these two species, but also a variety of the latter—var. *yezoense* of the author. The description of the *Chrysanthemum* species in Saghalien, Hokkaidô and Northern Nippon are given, viz. *C. yezoense* MAEKAWA, incl. three varieties, *typicum, stipulatum* and *lobulifolium*, *C. arcticum* L., *C. Gmelini* (LEDEB.) MIYABE et MIYAKE, *C. littorale* MAEKAWA and *C. Weyrichii* MIYABE et MIYAKE.

C. littorale grows in some limited portion of Hokkaidô. Plants produced from seeds may bear flowers only in their second or third year, and many of them are destined to death, while, on the contrary, in those derived from the stolons and rhizomes the death rate is considerably lower. The latter mode of reproduction is to be considered as a very efficient biological adaptation: since plants grow near the sea shore, and consequently exposed not only to violent wind, but also sometimes to the attack of sea waves, the reproduction by seeds will not be a very safe way of assuring their existence.

The statistical study of the number of ligulate flowers of this *C.* species has shown that its variation follows generally the FIBONACCI's series with its mode at 21. The author has found a special colony of this species growing wild at a certain locality, and observed that here the mode lies at 34; the fact is very interesting, inasmuch as it resembles somewhat the well-known case of selection experiment of DE VRIES on *C. segetum plenum.*

Under cultivation this species produces flowers in the second year of sowing. It

branches very richly, and accordingly a large number of heads is produced, which adds greatly to its beauty. The following observations made on cultivated plants are to be noticed. Firstly, the number of heads is greatest in the uppermost secondary branches, gradually diminishes downwards, and again increases somewhat towards the lowermost ones. Secondly, the average number of ligulate flowers for each head is greatest in the upper part of the stem, and decreases gradually downwards. Thirdly, in the head placed at the apex of the branch of any order the number of ligulate flowers is nearly constant.

The author recommends *C. littorale* as an ornamental plant, especially because it produces a large number of beautiful heads. Author.

165. On the Phenomena of Sex Transition in Arisaema japonica Bl. Tokujiro MAEKAWA. [Jour. Coll. Agric. Hokkaido Imp. Univ, Sapporo **13** (1924), 217–305, 1 pl. and 9 figs].

Arisaema japonica is a dioecious plant. The author's observations which begun with 1917 and are continued till now have shown the fact that even in one and the same individual the sex may vary in different years. The transformation of the asexual condition in one year to the male in another, and of the male to the female has been most frequently observed, while the corm in the female condition has rarely been transformed into the others. By following the manner of sex transformation of a single corm for the succeeding three to five years, the auther found that this process does not occur at random under ordinary condition but proceeds from the asexual state to the male and then from the latter to the female, whereupon the sex remains unchanged—*normal process of sex transition.* However, the transformations in the opposite direction have rarely been met with. To cite only a few instances, during 1920–21, among 137 very young male corms 57 transformed into the female, 75 remained in the same state and only 5 were reversed into the asexual; during 1917–8, among medium sized 57 corms which have produced the male inflorescence in 1917 only 3 remained male, whereas the females in 1917 remained female in the next year. Again, among 100 individuals observed during 1918–9 2 corms which were female in 1918 changed to the male in 1918. In the case of those corms which transform in the reverse direction, they used to change from female to the male condition and then from the latter to the asexual—the process of *retro-transition of sex.*

The influence of sandbed cultivation, i.e. of the extreme condition of life on the sex transition was studied, and it was found that it takes place in the same way as under the normal condition, though the rate of transition was reduced. It may be noticed that the one female in the first year became monoecious in its second year under such cultivation.

The weight of each of the three kinds of corms, asexual, male, and female has been ascertained, and it was found that it varies between 0,5–4,0 gr, 4–34 gr, and 11–410 gr (mostly above 21 gr) respectively. We see therefore that the sexual expression of corms is correlated with their respective weights. Though there is a transgression between the weights of the corms of each of the three conditions, we see that the general limiting line between asexual and male conditions lies at 4 gr, and that between male and female at 21 gr.

The transition from the female to male state, as well as that from the latter to the asexual are generally accompanied by the decrease in corm weight, and this transition takes place most frequently, when the latter stands near the limiting line between every two.

Various experiments were made to control the sex condition, viz. the partial cutting of leaf blades, the cutting away of the whole vegetative organs above ground, the partial cutting of corm body, and the cultivation in a dark room. By such means the weight of

corm has more or less been reduced, and as the consequence in many cases the retro-transition has taken place. The recovery of weight in the next year has led to the original state of sex.

The general conclusion of the author is as follows. The cytological and Mendelian interpretation of the sex determination now in current are not applicable to *Arisaema japonica*, and here the sex is determined by the quantity of the formative assimilation products, i.e. those in the fresh form before they are stored up in the reserve organ. A very young corm is asexual because the assimilation products formed during the season falls short to enable it to form the sexual scape for the next year. But when it grows out the quantity of the assimilation products produced by it becomes sufficient to meet the demand required for the male expression, and if the corm grows much larger, it may take the female expression, and then the sexual state becomes stable—normal process of sex transition. If the growth of the vegetative shoots becomes weakened or impaired the sexual expression is reversely transformed from female to male and from male to asexual—the process of retro-transition of sex. Some irregular transformations are similary explained under this point of view. The corm weight has no direct influence upon the sex determination; the greater it is the larger is the size of the assimilation organs produced, and consequently the greater is the quantity of the formative assimilation products. Thus though the relation of the corm weight to the sex determination is merely indirect, it may well serve as an index of the sexual expression. Author.

166. On the Development of Gloiopeltis. Hirozô MIYAZAKI. [Jour. Imp. Fish. Inst. **20** (1924), 3–6, 1 pl.]

In the genus *Gloiopeltis* a large number of shoots are found growing out from one scutate disc. Of three species examined *G. colifornis* has the largest disc, *G. cervicornis* the smallest one, while in *G. tenax* it is little larger than in the latter.

When the carpospore germinates a small thin membranaceous scutate disc is formed. A number of minute prominences arise from its upper surface, and give rise to the aerial fronds, of which we may count nearly 30 in *G. colifornis*, but 2–3, at most 6–7 in *G. tenax*, and only one in *G. cervicornis*.

The germination of the carpospore begins soon after its liberation from the cystocarp in May or June, and the formation of aerial shoots ist most abundant in October in *G. colifornis*. The disc thus formed seems to survive till the next year, when the decay of the aerial shoots takes place, or still till later. Author.

167. Botanische Beobachtungen über Japan. Hans MOLISCH. [The Science Rpts. Tohoku Imp. Univ, Sendai **1** (1924), 73–81, 1 Abb.]

1. Der Verfasser hat in *Botrychium ternatum* und *Ophioglossum vulgatum* überaus deutliche Elaeoplasten aufgefunden und beschrieben. Besonders schön ausgebildet sind die Elaeoplasten bei *Botrychium* in der Epidermis des Blattstiels und der Blattspreite ausgebildet. Sie sehen einem in Spiremstadium befindlichen Zellkern ähnlich und können damit leicht verwechselt werden. Der Zellkern liegt gewöhnlich daneben und tritt viel weniger deutlich hervor.

Der Elaeoplast besteht aus einem Haufen körniger und schleifenartiger Bildungen von plasmaartigem Aussehen und nimmt oft die ganze Breite der Zelle ein. Um ihn rasch sichtbar zu machen und zu fixieren, eignet sich besonders Osmiumsäure, er wird darin sofort schwarz oder blauschwarz. Bei schwacher Vergrösserung erscheinen die Elaeoplasten als kohlschwarze Punkte und jede Zelle zeigt einen solchen.

Nach den vom Verfasser ausgeführten Reaktionen handelt es sich hier um aus-

serordentlich distinkt ausgebildete Elaeoplasten. Dieselben Inhaltskörper fand der Verf. auch bei *Botrychium virginianum* und bei *Ophioglossum vulgatum*.

Das Vorkommen von Elaeoplasten bei *Botrychium* und *Ophioglossum* stellt ein gutes Beispiel dar, dass die Verwandschaft der Pflanzen sich auch in gewissen Bestandteilen des Zellinhaltes ausprägen kann.

2. Über einen neuen Pflanzenfarbstoff bei *Clerodendron trichotomum* Thuby.

Die Früchte dieser Pflanze glänzen im Sonnenlichte wie blaue Edelsteine und die auffallende Farbe rührt von einem blauen Farbstoff her, der in der Epidermis und im Fruchtfleisch seinen Sitz hat. Er findet sich ertweder gelöst oder in unregelmässig geformten Schollen vor. Der Farbstoff ist leicht in Wasser löslich, langsam löslich in Alkohol, unlöslich in Xylol, Äther, Chloroform und Schwefelkohlenstoff. Sehr verdünnte Säuren bringen keinen Farbenumschlag nach rot hervor, er kann also kein echtes Anthokyan sein, denn er ist bekannt, dass alle Authokyane sich mit verdünnten Säuren röten.

In sehr verdünnten Alkalien tritt ein Farbenumschlag nach grün ein und darin gleicht er dem Anthokyan. Der Farbstoff weicht von den Anthokyanen durch sein eigenartiges Verhalten gegenüber verd. Säuren ab, steht aber vielleicht doch dieser Farbstoffgruppe nahe.

Der Verfasser fand die Narbe der Plüte von *Monotropa uniflora* blau gefärbt und diese Färbung verdankt sie einen himmelblauen Farbstoff, der dem Farbstoff von *Clerodendron* insoferne ähnelt als auch er mit Säuren sich nicht rötet. Autoreferat.

168. Studies on Angular Leaf Spot of Cotton in Korea. (Japanese.) Kakugoro NAKATA, Tomosuke NAKAJIMA and Seito TAKIMOTO. [Bull. Agric. Exp. Sta. Chosen **10** (1924), 1-21 with 2 pl.]—Angular leaf spot of cotton is a common and destructive disease prevailing nearly through all cotton growing sections in Korea. It attacks seedlings, stems, bolls, and leaves and is characterized by angular lesion on the leaves. Occasionally the disease is associated with many diseases such as leaf blight (*Cercospora gossypina*), leaf spot (*Phyllosticta gossypina, Pestalozzia gossypii*) and anthracnose (*Glomerella gossypii*), and various symptoms are produced.

The occurrence of the disease depends upon the environmental conditions; lack of potassium fertilizer and wet climate especially favour its prevalence. Of fifty seven varieties of upland cotton tested Taxas Water, Franklin Prolific, Hastings Upright and Taisaku Upland are much resistant, King's Improved and Griffin's Improved less resistant to the disease. Our observations through all cotton varieties in Korea suggest us that the Chinese variety stands first and Korean as well as Indian next in resistance. Upland cotton, though a little different in resistance among its varieties, is generally susceptible to the disease.

The causal organism agrees with *Bact. Malvacearum* Smith in all respects except nonformation of windowed colony. The organism is resistant to dryness (two weeks in desiccator) and to heat (54-55°C for 10 min. in wet, 110°C for 10 min. in dry heat) and sensitive to lime sulphur (0.4 B. for 30 min.), Bordeaux mixture (2% for 10 min.), formalin (0.35% for 60 min.), carbolic acid (1% for 20 min.), corrosive sublimate (0.1% for 5 min.).

The infection is proved to be through seeds carrying the organism on their ground hair. The organism in diseased leaves which are scattered in open field loses its vitality during winter and has no power to produce the disease in the following season.

The effective measures for control are seed treatments, of which hot water treatment (60°C for 10 min.) and chemical treatment (0.1% corrosive sublimate for 10 min.) followed by delinting with commercial sulphuric acid are to be recommended for practice. Spray-

ing with Bordeaux mixture is not effective, unless repeatedly applied. Authors.

169. Dauer der Keimungsfähigkeit von Sporen einiger Schimmelpilze. (Japanisch). Ryôdi NAKAZAWA und Tokumatu KOBAYASI. [Report Dept. Industry, Governm. Research Inst., Formosa **5** (1924), 4. S.]

Wie lange die im getrockneten Zustande befindlichen Sporen keimungsfähig bleiben können, wird inbezug auf 61 Schimmelpilzarten untersucht. Die Resultate sind tabellarisch angegeben. Autoref.

170. Gipsmodelle einer Riesenkolonie von Hefenpilzen. (Japanisch). Ryôdi NAKAZAWA und Tokumatu KOBAYASI. [Report Dept. Industry, Governm. Research Inst., Formosa **5** (1924), 2 S., 1 Taf.]

Die Gipsmodelle der Riesenkolonien von Hefen, welche im Gegensatz zu den im Formalin konservierten Kolonien, natürlich unbegrenzt haltbar sind, wurden hergestellt. Die beigegebene Tafel gibt die photographischen Aufnahmen davon. Autoref.

171. Cytological Studies on Sciaphila japonica, Max. I. On Chromosome. Ichirô OHGA and Yosito SINOTÔ. [Bot. Mag. Tôkyô **38** (1924), 202–207, 6 figs.]

I. The haploid number of chromosomes counted in the pollen- and embryosac-mother-cells of *Sciaphila japonica,* one of the two Japanese species of Triuridaceae, is twenty-four, and the diploid number forty-eight. In an endosperm nucleus a triploid number of chromosomes, namely seventy-two, can be counted.

II. There are three kinds of the size of chromosomes, and their difference is conspicuous. Of the twenty-four gemini, two are strikingly large, two medium, and twenty small.

III. The pairing of chromosomes is recognized.

IV. The shape of chromosomes is rod-, V-, band-shaped, etc.

V. The position of arrangement of large gemini and large univalent chromosomes in a nuclear plate is generally peripheral, while the intermediate ones take the position at the periphery or among the small ones.

VI. It is suggested that *S. japonica* is a tetraploid. Authors.

172. Studies on the Formation of Seedless Grapes. (Japanese). Yasusi OINOUE. [Bulletin de l'Institut-Oinoue **1** (1924), 1–12, figs.]

The parthenocarpy in the grapes was observed by various ampelographists and they concluded that the seedless grapes are formed, because of the non-fecundation, owing to the weakness of pollen which is unable to germinate. There are several varieties of grapes which never possess seeds under normal conditions, and also by artificial cross-pollination. V. Pulliat informed that the variety White Corinth often produced seeds and A. Jurie noticed that he obtained seeded White Corinth by sacking the flower clusters. Müller-Thurgau studied the problem and concluded that White Corinth and other varieties of seedless berries have the degenerated female organs, but their pollen is able to germinate under normal conditions.

The author took the question again and tried to complete the theory of Müller-Thurgau. In the Experiment-Garden of his Institute he packed the flower clusters of Tchekerdeksiz (Thompson's Seedless) and White Corinth with various coloured papers, red, white and blue. The result of the experiment was very interesting: packed clusters produced seeded berries, except those under the red paper in the White Corinth, while in Tchekerdeksiz all produced seeds.

The author then packed the other clusters of the Tchekerdeksiz with ordinary paraffine paper and divided them into three parcels: in A parcel flowers were castrated

and pollinated with pollen of Aramon, in B they were simply castrated and in C they were self-pollinated. In A parcel fully developped berries were produced, in B the smallest berries were produced; in C parcel the normal development was seen and berries were medium-sized and of normal compactness.

The author examined the capacity of germination of pollen in these two varieties and he observed that about 80% germinated in the ordinary glucose solution at the temperature of 25°C. The author could observe that pollen tube has begun to develop 40 minutes after pollination and passed the style in 22 hours. The swelling of the ovary begun 50 minutes after pollination and just when the pollen-tube begun to enter the pistil. The ovule of seedless grape is not degenerated but the fecundation stops suddenly soon after, and consequently seeds could not be formed.

The author, on the basis of his experimental results, concluded that the so called seedless grapes are not due to the parthenocarpy, but to the incomplete fecundation which he calls " quasi-fecundation ". Author.

173. The Stability of the Factors and the Fixation of the Acquired Characters. (Japanese). Yasusi OINOUE [Bulletin de l'Institut-Oinoue **1** (1924), 101–120.]

The author holds the opinion against the current theories of the formation of new varieties and species. He occupies himself with plant breeding since more than 15 years and uses the special method. He states that the theory of mutation can hardly convince him, because many plants and animals produced the fixed variations under the culture or domestication non periodically and with strong intensity towards the direction we desired, leaving their ancestors almost non variable at the native spots. Dahlias, sweet peas, azaleas, grapes, pears, for instance, have given us thousands of varieties under culture with more or less fixed characters though their wild ancestors cast the offspring with slightest variation. The author denies the current explanation that these phenomena are due to the natural selection which saves the fittest and eliminates the others.

The author succeeded to get the yellow and rose varieties of wild chrysanthemum after five generations of most intensive and careful culture (about 0.3% of the seedlings) and he proved the fixity of these colours in the next generation. He then planted the new varieties in the uncultivated soil where he gathered the wild ancestors. Though he has sown repeatedly during 5 years seeds from these original wild plants and could not obtained new colours, yet seeds of new varieties grown at the same spot continued to breed true. These new races of the chrysanthemum are of strong and robust nature as their wild ancestors and the flowers are self fertile. The author got similar results in many other plants.

His conclusions are:

1. The variations appear under the influence of the environment in the pure-lined races as the primary variation (physiological variation).

2. The similar environment when repeated generation after generation, causes the posterior variation, and now it exerts its influence on the germ-cells.

3. If the same environment continues to influence further generations the great variation will occur. This variation is accompanied by the fixed characters and corresponds to the mutation of H. DE VRIES.

The author has gone into his hypothesis on the variation, which is hardly describable in comprehesible form in this short abstract.

174. Researches on the Variations Caused by the Graft in the Grapes and in the Other Fruit-trees. (Japanese). Yasusi OINOUE. [Bulletin de l'Institut-Oinoue **1** (1924), 13-72].

After many years of experimental studies the author concluded about the grafting as follows:

1. The affinity should be divided into A. pseudo-affinity, B. incomplete affinity, and C. complete affinity.
2. The affinity depends upon the histological and the physiological similarities.
3. The affinity is best when the polarity is not disturbed.
4. The affinity is greatest, the nearer the sections of the nodes.
5. Between different species or genera the affinity is of various intensity according to different races.
6. The affinity between the hybrids is proportional to the specific affinity of their components.
7. Between different species or genera the double or triple graft gives the good result (Ex. *Vinifera*-grape may be grafted to *rupestris* on *rotundifolia*).
8. Hybrids for the use of indirect stock must be newly made.
9. Between different species or genera, the affinity is not the same, when the scion and stock are reversed.
10. The graft variation does never inherit.
11. The graft variation is never fixed.
12. The graft variation may cause the bud variation.
13. The graft variation sometimes leaves the after effects.
14. The substances special to the scion or stock may pass according to their nature, from scion to stock or from stock to scion, or do pass neither from scion to stock nor from stock to scion.
15. Dwarfness is due to the small quantity of water absorbed relative to the diameter of the main stem.
16. Therefore scion grafted on a stock absorbing little water becomes dwarf.
17. The bourret of the graft decreases the quantity of water absorbed.
18. Mechanical obstacle to the absorption of water is caused not only by the bourret, but also by the smaller diameter of stock.
19. The mechanical action of the bourret is due to the anastomosis of the absorbing tubes.
20. The obstacles caused by the anastomosis decrease year after year.
21. Several anatomical structures are mixed up at the bourret, but separate out at the end of the bourret.
22. When the transpiratory power is not equal to that of absorption.

$X > Y$ causes the tallness

$X < Y$ causes the dwarfness

X=absorbing power, Y=transpiratory power.

23. The growth after grafting is

when $Vs = Vg$ $\quad Vg-(a+a')$ or $Vs-(a+a')$

and when $Vs \gtrless Vg$ $\quad \frac{Vg+Vs}{2}-(a+a')$

Vs=growing power of stock, Vg=growing power of scion, a=decreased power caused by the mechanical obstacles, a′=decreased power caused by the physiological differences.

24. Longevity of scion is due to the adaptability of the stock to the soil and

$$L=(L^2+l^2)-1$$

L^2=Longevity of scien, L=longevity after grafting, l=decreased quantity mechanically caused, l^2=increased or decreased quantity caused by the living power of stock, $l^2$is sometimes zero sometimes positive and sometimes negative.

Entry 174 (Cont.)

25. The scion lets fruits mature early, when the stock absorbs little water, sap is denser and the maximum quantity of potassium and phosphate are early absorbed.

26. The fruits of the scion are more sugary, being due to almost the same cause as 25.

27. The compactness of the grape clusters is dense, owing to the same cause as in 25.

28. The increase of volume of the fruits is generally contrary to 25. Author.

175. On the So-called Tundra-formation of the North Saghalien. Yônosuke OKADA. [Bot. Mag. Tôkyô **38** (1924), 76–83, 5 figs.]

Based on the observation during his trip to North Saghalien in the summer and winter season of 1923, the author gives in the present paper a brief note on the so-called Tundra-formation of that island. His conclusions are:

1) In North Saghalien there extends a wide tract of land which is there generally called tundra.

2) This term tundra now current in Saghalien does not coincide with the true tundra properly conceived in phytogeography, but has a far wider sense, covering all vegetations developed on peat-like soil.

3) So that the so-called tundra-formation may be classified into several types of formations, viz.—

a) Bushland and forest formation.
b) Dwarf shrub formation.
c) High-moor formation.
d) Low-moor formation.
e) Moss-tundra.

Author.

176. Icones of Japanese Algae. Kintarô OKAMURA. **5**, No **2** (1924), 5 pls. and 21–42.

This number contains *Cystophyllum sisymbrioides* J. Ag., *Sargassum serratifolium* Ag., *S. tortile* Ag., *S. enerve* Ag. and *S. Ringoldianum* Harv. Author.

177. Wirkungen der Elektrolyten auf die Lebenserscheinungen von Gonium pectorale und Pandorina Morum. (Japanisch). Tetsu SAKAMURA. [Bot. Mag. Tôkyô **38** (1924), (79)-(93)].

In Rohrzuckerlösungen von verschiedenem osmotischem Druck werden die Beweglichkeit und die phototaktische Reizbarkeit von *Gonium* sowie *Pandorina* gleichmässig stark beeinflusst. Erst in der über 0,2 molaren Konzentration der Rohrzuckerlösung wird die Beweglichkeit etwas retardiert und die Lichtempfindlichkeit aufgehoben.

Die sechzehn einzelnen Zellen, woraus eine Kolonie von *Gonium* aufgebaut ist, trennen sich früher oder später in gewissen Chloridlösungen der Alkali- oder Erdalkalikationen (einschliesslich $MgCl_2$), mit Ausnahme allerdings von $CaCl_2$. Diese spezifische Wirkung einzelner Salze auf den Zusammenhang der Zellen wird durch Zusatz von $CaCl_2$ beseitigt: hier ist also ein Antagonismus zwischen den Ca-Ionen und anderen Alkali- sowie Erdalkalikation zu bemerken.

Einzelne Zellen von *Gonium* sind im Kolonieverband von einer ziemlich dicken Gallerthülle umgeben, die wahrscheinlich aus Pektin oder pektinartigen Stoffen besteht. Die erwähnte Isolierung einzelner Zellen ist wohl dem Umstande zuzuschreiben, dass die Gallerthülle in der Lösung einzelner Alkalisalze oder Erdalkalisalze in löslichen Zustand übergeht, oder dass sie stark anquillt, wodurch die Verbindungsstelle der Zellen mechanisch getrennt wird. Bekanntlich sind Pektine, Kalksalze der Pektinsäuren, in den

Zellwänden der höheren Pflanzen als wasserunlösliche Bindemittel vorhanden. Auch bei *Gonium* kann man diese wichtige Rolle von Ca für die Kolonienbildung erkennen.

Im allgemeinen kommt in bezug auf die Beweglichkeit von *Gonium* und *Pandorina* einzelnen Alkali- oder Erdalkalisalzlösungen ein schädlicher Einfluss zu, indem sie anfänglich äusserst erregend, dann aber schnell lähmend wirken. Ca wirkt auch hier immer günstig, ohne solch extreme Wirkungen auszuüben, ja es wirkt sogar als ein antagonistischer Faktor gegen andere Kationen. Sr hat nur bei *Pandorina* in höheren Konzentrationen einen günstigen Einfluss als Ca. Die Reihenfolge der Kationenwirkung auf die Beweglichkeit ist je nach der Konzentration verschieden. Autor.

178. On Chromosome Behavior and Sex Determination in Rumex acetosa, L. Yosito SINOTÔ. [Bot. Mag., Tôkyô **38** (1924), 153–162, 40 textfigs.]

In the present paper the author dealt chiefly with the relation of chromosome behavior and sex determination in *Rumex acetosa*, and confirmed in the main the results of KIHARA and ONO concerning the same subject (cf. Abstracts, Japan. Journ. Bot. **2** (1924), Entries 33, 34.] Author.

179. Zur Kenntnis der Keimentwicklung bei Sargassum. Masato TAHARA. [The Science Reports Tohoku Imp. Univ. 4th Ser. **1** (1924), 91–95, mit Abbild.] S. Japan. Jour. Bot. **2** (1924), (35), Nr. 108.

180. On the Inheritance of the Spring versus Winter Form in Barley. (Japanese). Noboru TAKAHASI. [Japan. Jour. Genetics **3** (1924), 22–28, 1 fig.]

The winter barley, when sown in spring, shows the overgrowth in culms and leaves, and are unable to form ears as the rule, while the spring barley, when sown in autumn, is killed by winter cold. The cross between two forms gives in F_1 the spring form and in F_2 spring and winter forms in 3:1 ratio.

There are on the one hand some forms of barleys, which, when sown in spring, may grow like the normal spring form and yet, when sown in autumn, are able to withstand the winter cold ("intermediate" form). There is on the other hand some forms, which, when sown in spring, do not produce ears and yet, when sown in autumn, are killed by winter cold (pseudo-winter form). All experiments were performed in Suwon (Corea).

Author.

181. Chemische und Mykologische Untersuchungen über die Rhizopus-Arten. (Japanisch). Yosito TAKEDA. [Report Dept. Research Inst., Formosa (1924), 1–49, 5 Tafeln.]

Die reinen Kulturen auf Reis von *Rhizopus Oryzae* WENT et PRINSEN GEERLINGS, *R. V* NAKAZAWA, *R. formosensis* NAKAZAWA, *R. chinensis* var. *rugosporus* NAKAZAWA, *R. pseudochinensis* YAMAZAKI, *R. humilis* YAMAZAKI und vier andere Arten wurden unter zweimaligem täglichem Umschütteln während zweier Wochen auf einer Temperatur von 33° gehalten und ihr respektives Verhalten beobachtet. Unter diesen Bedingungen zeigen nämlich die Pilze ihre Verflüssings- und Verzuckerungsfähigkeit gegen Reisstärke am vorzüglichsten, während die Luftmyzelien und Sporangien nur spärlich entwickelt wurden. Die Annahme NAKAZAWAS, dass *R. Oryzae* WENT et PRINSEN GEELINGS sowie *R. V* NAKAZAWA zu einer und derselben Art gehören, wurde bestätigt. Unter den vom Verf. untersuchten Arten besitzt die Art *R. Pêka* I nov. sp., die bei der Bereitung von Biityû, ein alkoholisches Getränk in Formosa, gebraucht wird, durch ihre grösste Verflüssigungs- und Verzuckerungsfähigkeit gegen Reisstärke ausgezeichnet; ihre Diagnose wird angegeben und ihr chemisches Verhalten ausführlich erörtert.

Ebenso wird der zweite bei der Biityû-Bereitung vorkommende Pilz, *R. Pčka II* nov. sp. ausführlich beschrieben. Autoref.

182. Morphological Studies of Sugar-cane. Part II. Leaf-sheath. (Japanese). Yoshio TAKENOUCHI. [Report Dept. Agric., Governm. Research Inst., Formosa **5** (1923), 1–33, 8 pls.]

Each leaf-sheath grows out from the node and goes above into the leaf-blade. Its lower part is so broad that not only does it surround the entire circumference of the stem, but also its one margin overlaps the other; it is very remarkable, that the two manners of overlapping (i. e. left margin over right and vice versa) are alternating in succeeding nodes of each stem. A ligule is always present, while auricles may be present or not. The shape of each leaf-sheath, when expanded, may be said to be trapezoid. Colour is various, generally more or less green, rarely reddish purple. The duration is variable in different races, e. g. 71 days in average in a certain race. Growth takes place at the base. The epidermis consists of long cells and its anatomical struture is different in upper and lower surfaces. Stomata are present in both surfaces. The cross-section shows epidermis, fibrovascular bundles, bast-fibres groups and parenchyma.

The paper contains the general and special part. Author.

183. Morphological Studies of Sugar-cane. Part III. Stem. (Japanese). Yoshio TAKENOUCHI. [Report Dept. Agric., Governm. Research Inst., Formosa **6** (1924), 1–26, 11 pls.)

Each stem of sugar-cane consists of a number of nodes and internodes. The node is divisible into three narrow circular zones, viz. growth zone, root zone and waxy zone, the bases of leaf-sheaths being placed in the boundary of the two latter zones. The internode is that long part contained between the waxy zone and the upper part of the growth zone belonging to the next lower internode. The growth zone may be perhaps considered to be a part which is independent of the node and internode and then we may think that each stem consists of three parts, viz. internode, growth part and node. The growth of the stem depends exclusively on the action of the growth part. The root-zone is that from which roots spring out, and light coloured semi-transparent spots seen in that zone may under proper conditions give rise to roots. The colour of stem is various, green, yellow, white, brown, red, purple, etc. and is due to the pigment contained in the epidermal cells and 2–3 layers of underlying cells, as well as to the colour of cell-walls of long cells. The thickness growth of the stem takes place exclusively in young portions near the apex. Buds are alternately placed in succeeding nodes, each of which has always one of them, rarely more than one.

The paper is divided into the general and special parts. The general part contains the general description of the physical characters of stems, epidermis, fibrovascular bundles and parenchyma. The special part contains a comparative study on five races about the sujects just mentioned. Author.

184. Studies on the Seed-Abscission in Rice-plants of Formosa. (Japanese). Yoshio TAKENOUCHI. [Report Dept. Agric., Governm. Research Inst., Formosa, **8** (1924), 1–17, 6 pls.]

In various races of rice-plants a certain number of grains separate out generally from their stalks before harvest, and in some this process takes place very easily, so even by a slightest touch or wind. The proportion of grains thus falling down is generally much greater in Formosan rice-plants than in those cultivated in Japan proper, e.g. 20%, which naturally means a heavy loss of harvest.

For the abscission of rice-grains a special tissue is formed in the boundary between the grain and its supporting stalk. It consists of 1–3 layers of lignified thin-walled cells; it begins to develop already in the very young panicle and soon attains its full development. When the grains begin to ripen, cells of this abscission tissue become dry and the natural consequence is their separation from their stalks. The intensity of the development of this tissue is various according to different races, hence the difference in the easiness with which the grains fall down. In a few races no abscission tissue comes to development at all, hence in such cases the grains separate out from the stalks with much difficulty.

Author.

185. On a New Device of an Automatic Microtome for Celloidin Material. (Japanese). Hiroshi TAMIYA. [Bot. Mag. Tôkyô **38** (1924), (253)—(257), 2 figs.]

For paraffine materials we have generally two types of automatic microtomes, namely the MINOT type and the Cambridge type. These types, however, can not be directly adopted for celloidin material, which is very commonly used in the study of human and animal tissues, and is also sometimes employed in the study of lower plants. Mainly because of two reasons; one is, that the direction of the relative movements of the blade to the celloidin object must be oblique to the long axis of the knife, and the other, that the surface of the blade and of the material must be wetted with alcohol during the operation, in order to make a good sectioning. So we have so far been obliged to repeat very complicated and tedious processes with non-automatic types, such as JUNG's, SCHANZE's etc., when we made use of celloidin as imbedding medium.

The principle of the automatic type for celloidin materials designed by the author is as follows: the object to the sectioned is fixed vertically on one end of a horizontal arm, the other end of which is connected to the main axis of the apparatus. This arm repeats a certain portion of a rotary motion by the main axis, i.e. it makes a kind of a pendulum movement in a horizontal plane. At some distance from the axis, but a little shorter than the length of the arm, a knife is held horizontally, the long axis of which must be at a right angle with the middle line of the pendulum movements of the arm, so that the object carried by the arm be cut by the knife in oblique direction. The arm makes its pendulum movements by means of the wheel drive, and is gradually fed by any desired length before the object touches the blade, just similar in principle to that used in MINOT's rotary microtome. A tube from the alcohol tank opens upon the surface of the knife, and a certain quantity of alcohol drops on the knife at every sectioning. As the knife is held horizontally some alcohol always remains on its surface. A glass or china vessel containing some alcohol is placed under the knife, into which the sections from the surface of the knife are carried with a brush. As the dropping of alcohol and the feeding of the object are automatically carried out together with the cutting of the section, so on this apparatus the wheel should be turned with one hand, and the sections carried from the knife to the vessel with the other hand; the operation is accomplished in a much more simplified manner compared with the older methods.

With the same principle it is also possible to make an automatic dipping microtome for celloidin objects. In this the main axis is placed horizontally and the arm is dipped vertically into the alcohol, in which the sections are cut by the knife, so that each section sinks directly into the alcohol when leaving the knife.

The most important points in constructing these apparatus are that the main axis and the arm must be most rigidly made, and that the movements of the arm must be so precisely regulated, that every feeding of it be always constant. Author.

186. Principal Species of Citrus Fruits of the World. (Japanese). Tyôzaburô TANAKA. [Bulteno Scienca de la Fakultato Terkultura Kjûsu Imperia Universitato **1** (1924), 20–31].

1. Twelve species of *Citrus* described by SWINGLE in 1922 were redescribed here, as the result of the field survey conducted in the Orient and Europe, as well as from the study in the important herbariums of both East and West. A few revisions of the names were proposed. To this list, five hitherto imperfectly known species were added, among which one is new.

2. The greatest ambiguity and weakness of the taxonomy of the genus *Citrus* so far advanced, were here attributed to the lack of thoroughness in the type conception, allowing too liberal presumption for the origin of type and for the analysis of the distinguishing characters to which the feasibility of species segregation is solely dependent.

3. It was strongly suggested in this paper, that every type, whatever occurring wild or cultivated, should be observed critically as it is in the actual state, without regards of its origin by seeding or by grafting. Characters which are unique and specific are the only accessible basis of species determination, and from this point of view, segregation of types of so called "*nobilis* group" were proposed, as evidenced by the case of *C. nobilis*, *C. deliciosa*, and *C. unshiu*. Equal treatment of wild and garden species was therefore highly recommended under such circumstances.

4. It was also proposed that the garden species thus brought to the rank of the wild species should be named without authority, substituting the term "Hortulanorum" in its stead, as instanced by the name *C. unshiu* Hort. It was however not recommended to name any definite or presumable hybrid occurring cultivated in the gardens.

5. The concluding scheme of classification of the known *Citrus* species is shown in the following table:

1.	*Citrus medica* LINN.	Citron
2.	*Citrus Limon* BURM.	European lemon
3.	*Citrus aurantifolia* SWINGLE	Lime
4.	*Citrus maxima* (BURM) MERRILL	Pummelo
5.	*Citrus Aurantium* LINN.	Sour orange
6.	*Citrus sinensis* OSBECK.	Sweet orange
7.	*Citrus nobilis* LOUR.	King orange: Kunembo
8.	*Citrus deliciosa* TEN.	Mediterranean mandarin
9.	*Citrus unshiu* HORT.	Satsuma orange: Unshû mikan
10.	*Citrus mitis* BLANCO.	Calamondin: Tôkinkan
11.	*Citrus ichangensis* SWINGLE	Ichang lemon
12.	*Citrus bergamia* RISSO & POITEAU	Bergamot orange
13.	*Citrus histrix* DC.	Swangi orange *n. nom.*
14.	*Citrus macroptera* MONT.	Cabuyao orange *n. nom.*
15.	*Citrus limonia* OSBECK	Canton lemon *n. nom.*: Ning mung: Otaheite orange: Hirami lemon
16.	*Citrus limetta* RISSO	Lumia
17.	*Citrus junos* (SIEB.) TANAKA.	Yuzu: Kansu orange
18.	*Citrus tachibana* (MAKINO) TANAKA, n. sp.	Tachibana

6. Further addition to the list will be given as the result of the study now in progress.

Author.

187. An Experimental Study on Malt-sprout Poisoning. (English with Japanese

abstract.) Usio TANAKA. [Nippon-Zyûigakkwai-Zassi, Tôkyô 2 (1923), 93-99.]—The physiological disturbance of domestic animals caused by ingestion of malt-sprout, a by-product of beer-brewing is to be attributed to the action of hordenin, an alkaloid contained in it. The toxicity of the alkaloid is very weak, so that it is not always irrational to use the malt-sprout as an auxiliaty fodder. I. Amemiya.

188. Fungi Collected in the Islands of Rishiri and Rebun, Hokkaido. Kogo TOGASHI. [Japan. Jour. Bot. 2 (1924), 75-111, 1 pl.]

189. Ueber einen kurz nach der letzten Feuersbrunst plötzlich entwickelten Schimmelpilz. Yoshichika TOKUGAWA und Yoshikadzu EMOTO. [Japan. Jour. Bot. 2 (1924), 175-188, 1 Taf.]

190. Cytological Studies on Some Garden Varieties of Canna. Yoshichika TOKUGAWA and Yoshinari KUWADA. [Japan. Jour. Bot. 2 (1924), 157-173, 1 pl. and 7 figs.]

191. Studien über die Koralloide von Cycas revoluta. Kiyohiko WATANABE. [Bot. Mag. Tôkyô 38 (1924), 165-187, 12 Textabb.]

Die Bildung des Koralloides ist bei *Cycas* eine erbliche Eigenschaft. Zuerst ist es algenfrei, aber bald von der Alge infiziert, welche als eine endophytische *Anabaena* zu betrachten ist. Die Algen dringen im Koralloide durch die schizogenen Interzellularen ein, welche sie selbst geschafft haben. In den Koralloiden ist von vornherein eine plasmareiche und stärkefreie Schicht vorhanden, worin die Algen später eindringen und in ihren Interzellularen leben. Ob das Koralloid negativ geotropisch ist, ist zweifelhaft. Gewöhnlich und besonders im luftarmen Boden wachsen die Wurzeln der letzten Ordnung aerotropisch und ihre Enden wandeln sich zu Koralloiden um. Die proteolysierende Enzyme sind weder in den Wurzelspitzen noch in den Koralloiden nachweisbar, ebensowenig ist nach dem Verfasser die Assimilation des freien Stickstoffes durch die Koralloide annehmbar.

Obwohl die Alge ein reiner Parasit ist, ist ihr Schaden nicht gross. Sie fördert das Wachstum der Koralloide, welche als eine Hemmungsbildung zu betrachten ist. Falls die Algen ins Koralloid nicht eindringen, geht es bald zugrunde.

192. Notes on Some Mesozoic Plants from Japan, Korea and China, in the Collection of the Institute of Geology and Palaeontology of the Tohoku Imperial University. Hisakatsu YABE. [Science Rpt. Tôhoku Imp. Univ. 7 (1922), 1-28.]

193. Über die Anwendung der Becherschen Beizenfarbstoffe auf die Pflanzenkaryologie. Gihei YAMAHA [Bot. Mag. Tôkyô. 28 (1924), 61-75].

Von den Farbstoffen hauptsächlich aus den Gruppen der Anthrachinone und Naphtochinone, welche nach Becher (Becher., S., Untersuchungen über Echtfärbung der Zellkerne usw., Berlin, 1921) wegen der Echtheit sowie Reinheit ihrer Färbung als Kernfarbstoffe längst eingebürgertes Eisen-Hämatoxylin nach Heidenhain ersetzen sollen, wurden die folgenden zwölf mit pflanzlichen Objekten (Wurzelspitzen von *Vicia Faba* und Antheren von *Lilium speciosum*) auf ihrer Brauchbarkeit zum karyologischen Zwecke ausprobiert;—Purpurin, Alizarinbordeaux, Alizarinzyanin, Alizarinzyanin RR, Alizarinzyanin G, Anthracenblau, Säurealizarinblau, Naphtazarin, Naphtopurpurin, Alizarindunkelgrün, Gallozyanin, Gallaminblau.

Dabei bestätigte es sich, dass das Färbevermögen bzw. die Färbungsreinheit jedes Farbstoffes nicht nur von den Beizmittel (Lösungsmittel), sondern auch vom angewandten Fixiermittel abhängig ist. Die Ergebnisse der Färbeversuche wurden tabellarisch dargestellt. Aus alkalischen Lösungen (0,1 proz. Farblösung in 2,5 proz. Borax mit

oder ohne Zusatz von Borsäure) ist nur bei dem mit Bouinschem oder Zenkerschem Gemische fixierten Material eine brauchbar reine Kernfärbung zu erzielen. Bei anderweitiger Fixierung wie mit Flemmingscher oder Hermannscher Lösung wird der Kern ohne Vorbeizen, z. B. mit essigsaurer Tonerde, Eisenalaun, zu schwach gefärbt, wodurch aber die Echtheit der Färbung etwas beeinträchtigt zu werden scheint. Auch bei der Färbung mit gelösten Metalllacken (Farbstoff gesättigt in 5 oder 10 proz. Aluminiumchlorid, Aluminiumsulfat, Kalium-, Natrium-, Ammonium-, Chrom- und Eisenalaun) liefern Purpurin, Naphtazarin und Naphtopurpurin zumeist blasse Färbung, so dass sie abgesehen von dem mit Pikrinsäure- oder Sublimathaltigem Fixiermittel fixierten Objekte keine Anwendung finden können.

24-stündige Färbung mit Anthracenblau, Säurealizarinblau und Alizarindunkelgrün lässt dagegen häufig zu starke Färbung herauskommen. Bei jeder Fixierung wurden folgende Farbelösungen als brauchbar reine Kernfärbung gebende hervorgehoben:— Alizarinbordeaux in Al-sulfat, K-oder Na-Alaun; Alizarinzyanin in Cr-, K-, oder Na-Alaun; Alizarinzyanin RR in Al-sulfat, K-, Na- oder NH_4- Alaun; Alizarinzyanin G in Al-sulfat, K-, Na-, NH_4- oder Cr-Alaun; Anthracenblau in Na- oder Cr-Alaun; Säurealizarinblau in NH_4- oder Cr-Alaun; Alizarindunkelgrün in Na- oder NH_4- Alaun; Naphtazarin in K- Alaun: Gallaminblau in K- oder NH_4- Alaun.

Dass verschiedene Fixiermittel sowohl auf die Farbennuanzen als auch auf die Intensität der Färbung im nicht geringen Masse von Einfluss sein können, lässt den Gedanken aufkommen, dass beim Färbeprozesse das Fixiermittel eine bedeutsame Rolle spiele, und dass die Echtfärbung daher nicht durch eine Tripel- sondern Quadrupelverbindung zwischen Gewebe+Fixiermittel einerseits und Beize+Farbstoff andererseits bedingt werde.

Im Vergleiche mit Eisenhämatoxylinfärbung zeichnet sich die progressive Kernfärbung mit Beizenfarbstoffen Bechers durch ihre unübertroffene Echtheit und ziemliche Durchsichtigkeit aus. Zum Schluss äussert sich Verfasser auf Grund seiner Nachprüfung dahin, dass die Becherschen neuen Farbstoffe ebenso wie Eisenhämatoxylin Heidenhains auch in pflanzenkaryologischem Technik eingeführt werden sollen. Autoref.

194. Eine neue Art von Anoectochilus. Yosimatu YAMAMOTO. [Bot. Mag. Tôkyô **39** (1924), 131–133, 12 Abbild.]

Eine neue Orchidaceenart *Anoectochilus yakushimensis* aus Ins. Yakusima in Südjapan wird lateinisch beschrieben und abgebildet.

195. Genus novum Orchidacearum ex Formosa. Yosimatu YAMAMOTO. [Bot. Mag. Tôkyô **38** (1924), 209–214, 12 Abbild.]

Eine lateinische Beschreibung der neuen Gattung *Tuberolabium*. Eine dazu gehörende Art *T. kotoense* wird beschrieben und illustriert.

196. On the Relation between the Amount of Transpiration and the Development of the Vascular System in Rice-plant. (Japanese). Sadao YASUDA. [Bulteno Scienca de la Facultato Terkultura, Kjušu Imperia Universitato **1** (1924), 1–18.]

This study was undertaken to see the relation between the amount of transpiration and the development of the vascular system of *Oryza sativa*. As the index of the latter the cross sectional area of the vascular portion and number of the vascular bundles at the basal part of the leaf blade were taken, and the former was measured by means of the weighing method, the leaf only being generally used.

The relation T/G, where T denotes the amount of transpiration per unit leaf area and time, and G the ratio of the cross area of the vascular portion to the leaf area has been

studied on some strains. It was found that the quotient T/G=k is essentially constant in every case in one and the same strain cultivated under identical conditions. It is of course variable under different conditions, either external or internal, for instance, different methods of cultivation, different strains. So far as the author's studies go, the most important internal factors concerned here seem to be the structure, the number and the function of the stomata and the nature of the external wall of the epidermal cells.

Author